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SMITHSONIAN INSTITUTION.
UNITED STATES NATIONAL MUSEUM.

# BULLETIN

OF THE

# UNITED STATES NATIONAL MUSEUM.

## No. 47.

# THE FISHES

OF

# NORTH AND MIDDLE AMERICA:

A DESCRIPTIVE CATALOGUE OF THE SPECIES OF FISH-LIKE VERTEBRATES FOUND IN THE WATERS OF NORTH AMERICA, NORTH OF THE ISTHMUS OF PANAMA.

BY

DAVID STARR JORDAN, Ph.D.,
PRESIDENT OF THE LELAND STANFORD JUNIOR UNIVERSITY,

AND

BARTON WARREN EVERMANN, Ph.D.,
ICHTHYOLOGIST OF THE UNITED STATES FISH COMMISSION.

## PART I.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1896.

Miss Caroline A. Thom

SMITHSONIAN INSTITUTION.
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WASHINGTON:
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1896.

# ADVERTISEMENT.

This work (Bulletin No. 47) is one of a series of papers intended to illustrate the collections belonging to the United States, and constituting the National Museum, of which the Smithsonian Institution was placed in charge by the act of Congress of August 10, 1846.

The publications of the National Museum consist of two series—the Bulletins, of which this is No. 47, in continuous series, and the Proceedings, of which the eighteenth volume is now in press. A small edition of each paper in the Proceedings is distributed in pamphlet form to specialists, in advance of the publication of the bound volume.

The Bulletins of the National Museum, the publication of which was commenced in 1875, consist of elaborate papers based upon the collections of the Museum, reports of expeditions, etc., while the Proceedings facilitate the prompt publication of freshly-acquired facts relating to biology, anthropology, and geology, descriptions of restricted groups of animals and plants, the discussion of particular questions relative to the synonymy of species, and the diaries of minor expeditions.

Other papers, of more general popular interest, are printed in the Appendix to the Annual Report.

Full lists of the publications of the Museum may be found in the current catalogues of the publications of the Smithsonian Institution.

Papers intended for publication in the Proceedings and Bulletins of the National Museum are referred to the Committee on Publications, composed as follows: FREDERICK W. TRUE (chairman), R. EDWARD EARLL (editor), J. E. BENEDICT, OTIS T. MASON, LEONHARD STEJNEGER, and LESTER F. WARD.

S. P. LANGLEY,

*Secretary of the Smithsonian Institution.*

WASHINGTON, D. C.,

*March 18, 1896.*

SMITHSONIAN INSTITUTION.
UNITED STATES NATIONAL MUSEUM.

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# Dedicated to the Memory

OF

THOSE ICHTHYOLOGISTS OF THE PAST WHO HAVE STUDIED AMERICAN FISHES IN AMERICA,

IN TOKEN OF

"THE ONLY REWARD THEY ASKED—A GRATEFUL REMEMBRANCE OF THEIR WORK."

Georg Marcgraf, 1610–1644.
Maurice of Nassau, 1604–1679.
Charles Plumier, 1646–1704.
George Wilhelm Steller, 1709–1745.
Mark Catesby, 1679–1749.
Hans Sloane, 1660–1752.
Patrick Browne, 1720–1790.
Alexander Garden, 1730–1791.
Antonio Parra, 1750*–1800.
Johann David Schöpf, 1752–1800.
Stephan Krascheninikow, 1786*.
Petrus Simon Pallas, 1741–1811.
Otto Fabricius, 1744–1822.
William Dandridge Peck, 1763–1822.
Jean Baptiste Spix, 1781–1826.
Samuel Latham Mitchill, 1764–1831.
William Theophilus Tilesius, 1775*–1835*.
Charles Alexandre Le Sueur, 1780*–1840*.
Constantine Samuel Rafinesque, 1784–1842.
James Ellsworth De Kay, 1799–1851.
Zadock Thompson, 1796–1856.
Alexander von Humboldt, 1796–1859.
Ramon de la Sagra, 1810*–1860*.
Claude Gay, 1800–1863.
John Richardson, 1787–1865.
Robert Hermann Schomburgk, 1804–1865.
Francis de Castelnau, 1800*–1865*.
George Suckley, 1830–1869.
John Edwards Holbrook, 1794–1871.
Louis Agassiz, 1807–1873.
Herbert Edson Copeland, 1849–1876.
Jared Potter Kirtland, 1793–1877.
James William Milner, 1841–1880.
Samuel Stehman Haldeman, 1812–1880.
Charles Robert Darwin, 1809–1882.
Charles Leslie McKay, 1854–1883.
Spencer Fullerton Baird, 1823–1887.
James Carson Brevoort, 1818–1887.
Philip Henry Gosse, 1810–1888.
Silas Stearns, 1859–1888.
Charles Harvey Bollman, 1868–1889.
Felipe Poey y Aloy, 1799–1891.
William O. Ayres, 1817–1891.
David Humphreys Storer, 1804–1891.
Philo Romayne Hoy, 1816*–1893.
Charles Girard, 1822–1895.
John Adam Ryder, 1852–1895.
Marshall McDonald, 1836–1895.

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* Circa.

# PREFACE.

In this work the writers have endeavored to give concise descriptions of all the species of fishes known to inhabit the waters of North and Middle America. In scope the work includes, therefore, all the species known to exist in North America, Central America, the West Indies, the Caribbean Sea, the Galapagos Archipelago, with the offshore banks and continental slopes of both oceans included, as well as the waters of the Gulf Stream. All marine species known to occur north of the Equator, and all fresh-water species north of the Isthmus of Panama are included. The fact that over a hundred species have been added to the list within the time taken for printing the present volume, shows that this catalogue is still far from complete.

The classification and sequence of groups adopted by us is essentially that of Dr. Theodore Gill, freely modified to suit our present purposes. This system in many of its details is purely tentative, to be confirmed or changed when the anatomy of the various forms is better known. This fact has been strongly emphasized by Dr. Gill and needs no further discussion here. In the arrangement of the families and genera we have endeavored to avoid unnatural associations and incoherent groups, even at the risk of what may seem an excessive subdivision. In general, however, no correct idea of the relation of large groups can be formed until the component parts are separated and defined.

The rules of nomenclature recently formulated by the American Ornithologists' Union, and now adopted by nearly all American naturalists, have been followed in this work. The only exceptions are those arising from the operation of two minor regulations which seem to be impracticable or unnecessary.*

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*The first of these exceptions concerns Canon XVII, 2, which gives to specific names applied to males, precedence over names used for females, when the two occur on the same page. In such cases of synchronous names, we have awarded priority to the name standing first on the page, regardless of other considerations. The other exception is in the rule abandoning a name (as *Scaphirhynchus*; *Xiphidion*; *Canthidermis*) when a prior generic name is of like etymology and of nearly the same spelling (as *Scaphorhynchus*, *Xiphidium*, or *Acanthoderma*). We regard all generic names as different unless originally spelled alike, and the original orthography (misprints aside) is in all cases retained.

The present work is, in a sense, a revision of the "Synopsis of the Fishes of North America," published in 1883 by Jordan & Gilbert, as Bulletin XVI of the United States National Museum. While the general character of the work is the same as in the Synopsis, the text in the present work has been entirely rewritten, and the geographical range greatly extended by the addition of the faunas of Mexico, Central America, and the West Indies. The number of species included has been thus more than doubled. An effort has been made to show in the sequence of forms, something of our knowledge of the line of evolution of the different groups of fishes.

Our recognition of indebtedness should include in greater or less degree most contemporary workers in systematic ichthyology, for it is not easy to separate the aid given to our individual studies from that given as direct assistance in the preparation of the present work.

Dr. Charles Henry Gilbert has turned over to the present junior author his share in Jordan & Gilbert's "Synopsis," and has also freely given help and advice, unpublished observations, descriptions of new forms, and other aids which increase the usefulness of the work. Most of the descriptions here published have been written in his laboratory or verified in the museum in his charge.

In ways similarly important, we are under the deepest obligations to Dr. Theodore Gill, who has looked over all our proof sheets, and who has given numberless valuable suggestions arising from his extensive knowledge of comparative anatomy and of the literature of zoölogy. Every part of the work has been made more valuable by the friendly interest of this master of taxonomy.

Still other aids of importance have come from Dr. G. Brown Goode, Assistant Secretary of the Smithsonian Institution in charge of the United States National Museum. The work of rewriting the Synopsis of 1883 was undertaken at his suggestion. Every help toward its completion has been freely extended, the most important being the use of the advance proof-sheets of the "Oceanic Ichthyology" of Goode & Bean.

To Timothy Hopkins, esq., of Menlo Park, Cal., a generous patron of biological research, we are indebted for the kind interest which made it possible for the junior author to associate himself with the present work.

Dr. George A. Boulenger, of the British Museum of Natural History, has examined many type specimens for us, and has most kindly furnished advance proof-sheets of the first volume of his Catalogue of Teleostean Fishes. Large use of these proof sheets has been made in our accounts of the *Percidæ* and *Serranidæ*.

Valued aids in the solution of doubtful questions have been received from Dr. Franz Steindachner of Vienna, Dr. Franz Hilgendorf of Berlin, Dr. Christian F. Lütken of Copenhagen, Dr. Robert Collett of Christiania, and from Dr. Léon Vaillant, M. F. Bocourt, and M. Alexandre Thominot, in Paris.

In our own country, we have especially to express our obligations for favors received from Dr. Tarleton H. Bean, of the New York Aquarium; from his brother, Mr. Barton A. Bean, and Mr. R. Edward Earll, of the United States National Museum; from Prof. Edward D. Cope, of Philadelphia, and Mr. Samuel Garman, of the Museum of Comparative Zoölogy; Dr. Hugh M. Smith and Mr. William C. Kendall, of the United States Fish Commission; Dr. Stephen A. Forbes, of the University of Illinois; Dr. Edwin J. Nolan, of the Academy of Natural Sciences of Philadelphia, and Prof. Simon H. Gage, of Cornell University. To the Hon. Marshall McDonald, United States Commissioner of Fish and Fisheries, and Mr. Richard Rathbun, chief of the Division of Scientific Inquiry of the United States Fish Commission, we are under especial obligations for assistance in many ways.

Our own students, present and past, especially Dr. Seth E. Meek, Dr. Wilbur W. Thoburn, Mr. Edwin C. Starks, Dr. Frank Cramer, Dr. Carl H. Eigenmann, Mr. Albert J. Woolman, Mr. Cloudsley Rutter, Mr. Keinosuke Otaki, Mr. Thomas M. Williams, Mr. George B. Culver, Mr. Norman B. Scofield, Miss Susie B. Bristol, Mrs. Flora Hartley Greene, and others, have rendered aid of various kinds. Dr. Meek has devoted a winter in Palo Alto to the preparation of the first draft of the account of the *Pomacentridæ*, *Gadidæ*, *Brotulidæ*, and other families. Mr. Cramer is the author of the account of the *Scorpænidæ* and *Agonidæ*, and to Dr. Thoburn we owe the outline of the *Cottidæ*. Mr. Starks has spent much time in the verification of descriptions. An especially important service has been rendered by Prof. Walter Miller of the chair of Archæology in Leland Stanford Junior University, and Mr. William Barnum, Editor of the United States Fish Commission publications, in reviewing and correcting the etymology of names of the genera and species. Prof. Augustus T. Murray, of the chair of Greek in the Leland Stanford Junior University, has also contributed valuable suggestions. To Mr. George A. Clark, President's Secretary of the Leland Stanford Junior University, we owe many favors in connection with the preparation of manuscript.

Under the head of each species, enough synonymy has been given to connect this work with other descriptive works, and no more. Reference is made to each original description of supposed new species or genera, to the descriptions in Dr. Günther's "Catalogue of the Fishes of the British Museum," to Jordan & Gilbert's "Synopsis of the Fishes of North America," and to other works in which special information is given. The limits of the present work prevent us from giving a bibliography of the works consulted. In general, we have tried to examine every paper which throws light on American Ichthyology.

In conclusion, we may say that no one can realize the imperfections of this work more keenly than we do. We offer no excuse for inaccuracies and errors, but it is fair to say that, throughout the four years in which this work was written, both its authors have found their energies crowded to the utmost by executive work to which systematic ichthyology bears no relation. Had it not been so, this book would have come somewhat nearer our own ideals, and especially would it be more exact and detailed on the side of Osteology, Embryology, and Palæontology. As it is, we trust that the work will be a useful representation of the present state of our knowledge of the fauna in question.

David Starr Jordan,
Barton Warren Evermann.

Leland Stanford Junior University,
Palo Alto, Santa Clara County, California.
*March 15, 1895.*

# NOTE.

In our descriptions of species, we have attempted to bring the principal comparative measurements first. The expressions "head 4," or "depth 4" mean that the length of the head in the one case, or the greatest depth of the body in the other, is contained 4 times in the length of the fish measured from the tip of the snout to the end of the last caudal vertebra, the caudal fin being not included. The size of the eye and the length of snout and other head parts are compared with the length of the side of the head, unless otherwise stated; thus "eye 5" means that the horizontal diameter of the eye is $\frac{1}{5}$ the length of the head. "Scales 5–64–7" means that there are 5 rows of scales between the base of the dorsal fin and the lateral line (the scale in the lateral line excluded), 64 oblique transverse series crossing the lateral line, and 7 horizontal series between the lateral line and the base of the anal or the vent. When the number of pores in the lateral line is fewer than the number of scales in it, we have usually indicated the fact.

The fin formulæ are usually shortened as much as possible; thus D. 10," "D. IV, 9," or "D. VIII–13," means that in the first case the fish has a single dorsal fin of 10 soft or articulated rays; in the second case, a single dorsal fin of 4 spines and 9 soft rays; and the last indicates a fish with 2 dorsal fins, the first composed of 8 spines and the second of 13 rays.

Spines are always indicated in roman letters.

The abbreviations for the other fin formulæ are similarly explained.

The measurements given in the text are intended to apply to the average of mature fishes. Young fishes usually have the depth less, the head and eye larger, and the mouth smaller, than adult examples of the same species.

Descriptions not taken from specimens, or at least not verified by us, are credited to the author from whom they have been copied.

"Eu." after the account of any species indicates that it is found in Europe.

The names of the localities from which the types of the species were obtained, are printed in antique old style type in connection with the synonymy of each species.

When the type specimens are in the United States National Museum, we have given the numbers which they bear on the register of that institution.

An atlas, containing anatomical figures and illustrations of many of the more important species, is now in preparation and will appear upon the completion of the second volume of the present work.

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# THE FISHES

OF

# NORTH AND MIDDLE AMERICA.

BY DAVID STARR JORDAN AND BARTON WARREN EVERMANN.

Ichthyology (*ἰχθύς*, fish; *λόγος*, a discourse) is the study of fishes. A "fish," in the popular sense, is a member of any one of the three classes of aquatic or fish-like vertebrates, the groups here designated as *Leptocardii*, *Marsipobranchii*, and *Pisces*. The *Tunicata* and *Enteropneusta (Balanoglossus)*, now recognized as belonging to the CHORDATA and approximated to the VERTEBRATA, are excluded in this definition, as in their adult condition these creatures have undergone a retrograde metamorphosis and are by no means fish-like. For an opposite reason, the BATRACHIA, which develop jointed limbs in their adult condition, although closely allied to the true fishes, are not included in the popular idea of a fish.

Among the forms commonly called fishes we recognize three classes—*Leptocardii*, *Marsipobranchii*, and *Pisces*. We have preferred to leave the *Pisces* as a single class, including all fish-like vertebrates with paired fins, though there is much to be said in favor of regarding the Selachians and Dipnoans as each constituting a distinct class coördinate with the true fishes and the Batrachians. We see no warrant for separating the Ganoids as a class from the true fishes, still less for uniting the Ganoids and Selachians in one class, *Palæichthyes*, while the true fishes are placed in another.

## ANALYSIS OF THE CLASSES OF FISH-LIKE VERTEBRATES.

*a*. *Acraniata.*—Anterior end of the central nervous axis not dilated into a brain and not surrounded by a protective capsule, or skull.

- *b*. Notochord perfect, persistent, extending throughout the body, included in a membranous sheath, as is the cord-like nervous axis above it; body elongate, lanceolate, not worm-like nor enveloped in a tunic; walls of the body with muscular myotomes; middle line of body with rudimentary fins; no proboscis; the mouth slit-like, fringed with cirri; heart a longitudinal tubular vessel which gives off branchial tubes which unite in an aorta; gill slits inclosed externally by a fold in the integument which incloses a chamber (atrium) which opens below; vent remote from mouth. LEPTOCARDII, I.

*aa*. *Craniota.*—Anterior end of the nervous axis dilated into a brain which is contained within a protective capsule, the skull; notochord not continued forward beyond the pituitary body; heart developed and divided at least into two parts.

- *c*. Skull imperfectly developed and without jaws; shoulder girdle and pelvis obsolete; no paired fins; a single median nostril; gills purse-shaped; skin naked; skeleton cartilaginous. MARSIPOBRANCHII, II.
- *cc*. Skull well developed, and with jaws; shoulder girdle and pelvis more or less developed; nostrils not median; gills not purse-shaped; limbs, if present, developed as rayed fins, never with fingers and toes like those of the higher vertebrates; gills persistent through life. PISCES, III.

## Class I. LEPTOCARDII.

### (The Lancelets.)

Skeleton membrano-cartilaginous. Notochord persistent and extending to the anterior end of the head, inclosed in a membranous sheath as is the cord-like nervous axis above it. Heart a longitudinal tubular vessel which gives off branchial vessels which unite in an aorta; end of the nervous axis not dilated into a brain and not surrounded by a protective capsule, or skull. Blood colorless. Respiratory cavity confluent with the cavity of the abdomen; gill slits in great number, the water being expelled through an abdominal pore in front of the vent. Jaws none; the mouth a longitudinal fissure, with cirri on each side. Body lanceolate in form, more or less fish-like, and not enveloped in a tunic. Dorsal fin present, low; anal fin usually more or less developed.

Small marine animals, highly interesting to the zoölogist as exhibiting the lowest degree of development of the vertebrate type. The class includes but the single order, Amphioxi or Cirrostomi. (*λεπτός*, thin; *καρδία*, heart.) (Subclass Leptocardii, Günther, Cat., viii, 513–514.)

## Order A. AMPHIOXI.

### (The Cirrostomes.)

This order is equivalent to the family Branchiostomidæ. (*ἀμφί*, both; *ὀξύς*, sharp: *Cirrostomi* is from *cirrus*, a lock of hair; *στόμα*, mouth.) (Cirrostomi, Günther, Cat., viii, 513–514.)

### Family I. BRANCHIOSTOMIDÆ.*

### (The Lancelets.)

Body elongate, lanceolate, compressed, naked, colorless; the fins represented by a low fold extending along the back, with usually a rudimentary fold below which passes by the vent to the abdominal pore. Mouth inferior, appearing as a longitudinal fissure, surrounded by conspicuous, rather stiff, cirri. Eye rudimentary. Liver reduced to a blind sac of the simple intestine. Small, translucent creatures found imbedded in the sand on warm coasts throughout the world. Eight species are now recognized, referable to 2 or 3 genera. They are all very similar in appearance and habits, and the numbers of the muscular impressions furnish the only characters thus far known by which the species can be distinguished.† (Cirrostomi, Günther, Cat., viii, 513–514.)

*a.* Gonads (reproductive structures) present on both sides of the median line; anal fin present, with traces of fin rays; no caudal process. Branchiostoma, 1.

*aa.* Gonads present on the right side only; anal fin without fin rays or successive fin-ray chambers; a long caudal process, or tail, about as long as the head. Asymmetron, 2.

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* In the arrangement of the genera and species of this group we have been guided by the conclusions of Dr. E. A. Andrews, in his recent paper, "An undescribed Acraniate: *Asymmetron lucayanum*." (Studies Biol. Lab. Johns Hopkins University, v, No. 4, 213–247, 1893.)

† See Günther, Rept. Zoöl. Voyage H. M. S. Alert, 1884, where the value of this character is first fully recognized.

## 1. BRANCHIOSTOMA, Costa.

(LANCELETS.)

*Branchiostoma*, COSTA, Cenni Zoölogici Napol., 49, 1834, (*lubricum* = *lanceolatum*).
*Amphioxus*, YARRELL, British Fishes, 468, 1836, (*lanceolatus*).

Lancelets with the gonads or reproductive structure present on both sides of the median line. Anal fin present, with traces of rays. Vertebral column not produced backward into a caudal process. Six or 7 species recognized, found in the warm seas, usually buried in sand flats at no great depth. They are very tenacious of life, and will endure considerable mutilation. (*βράγχια*, gills; *στόμα*, mouth, the cirri about the mouth having been taken for gills by Costa).

*a.* Myocommata or muscular bands, 58 to 64.
  *b.* Myocommata behind vent, 11 to 13, the formula usually 35 + 14 + 12 = 61. LANCEOLATUM, 1.
  *bb.* Myocommata behind vent, 7 to 10, the formula usually 35 + 14 + 9 = 58. CARIBÆUM, 2.
*aa.* Myocommata or muscular bands, 65 to 70, the usual formula 44 + 16 + 9 = 69; size larger than in other American species; the tail short. CALIFORNIENSE, 3.

### 1. BRANCHIOSTOMA LANCEOLATUM, (Pallas).

(EUROPEAN LANCELET; AMPHIOXUS.)

Muscular bands usually 35 + 14 + 12 = 61. Usual length 1½ inches. The common European species, with the tail stoutish and rather long; abundant on the sandy shores of the Mediterranean, and known from Southern England and Scandinavia. The Lancelet of the Chesapeake Bay, according to Dr. Andrews, is referable to this species rather than to *B. caribæum*. (*lanceolatus*, lance-shaped.) (EU.)

*Limax lanceolatus*, PALLAS, Spicilegia Zoöl., X, 19, 1774, Cornwall.
*Branchiostoma lubricum*, COSTA, Cenni Zoöl. Napol., 49, 1834, Naples.
*Amphioxus lanceolatus*, YARRELL, British Fishes, 468, 1836, and of many writers on anatomy; GÜNTHER, Cat., VIII, 513, 1870; JORDAN & GILBERT, Synopsis, 867, 1883; GÜNTHER, Rept. Zoöl. H. M. S. Alert, 32, 1884; ANDREWS, Studies Biol. Lab. Johns Hopkins Univ., v, 238, 1893.

### 2. BRANCHIOSTOMA CARIBÆUM,* Sundevall.

(WEST INDIAN LANCELET.)

Muscular bands (myocommata) usually 35 + 14 + 9 = 58; gonads 22 to 26 on each side; usual length 1⅜ inches; tail short; extremities attenuate. In shallow waters, buried in the sand, from Beaufort, N. C., to the mouth of the La Plata; abundant off the Carolina coast and in localities in Florida (Port Tampa), Jamaica, Brazil, etc. (Name from the Caribbean sea.)

*Branchiostoma caribæum*, SUNDEVALL, Ölfers, Vet. Akad. Förhandl., 12, 1853, St. Thomas; Rio Janeiro; GÜNTHER, Voyage Alert, 32, 1884; JORDAN & GILBERT, Synopsis, 3; ANDREWS, *l. c.*, 240, 1893.

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* This species is not very different from *B. lanceolatum*, and may vary into it.

### 3. BRANCHIOSTOMA CALIFORNIENSE,* Gill.

(California Lancelet.)

Larger than the other American species, with the muscular bands in greater number, usually 44 + 16 + 9 = 69. Tail very short. Usual length 70 mm., or nearly 3 inches. Coast of California, from San Diego Bay southward, very abundant at the mouth of San Diego Bay, where it was first obtained by Dr. J. G. Cooper about 1868; lately taken in large numbers at San Diego and at San Luis Gonzales Bay, in the Gulf of California. In specimens from the last-named locality (Albatross Coll.) the usual formula is 45 + 14 + 9 = 68.

*Branchiostoma*, species, Cooper, Cronise, Nat. Wealth California, 489, 1868, San Diego.
*Branchiostoma californiensis*, Gill, MS., Andrews, *l. c.*, 241, 1893.

## 2. ASYMMETRON, Andrews.

? *Epigonichthys*,† Peters, Berl. Monatsber., 327, 1876, (*cultellus*).
*Asymmetron*, Andrews, Studies Biol. Lab. Johns Hopkins Univ., v, 237, 1893, (*lucayanum*).

Gonads, or reproductive structures, developed on the right side only. Anal fin without fin rays or successive fin-ray chambers. A long caudal process. Otherwise as in *Branchiostoma*. One species. (*ἀ-σύμμετρος*, wanting symmetry.)

### 4. ASYMMETRON LUCAYANUM, Andrews.

(Bahama Lancelet.)

Right metapleuron continuous with the median ventral (anal) fin, which passes to the right of the anus. Preoral hood extensive, the cirri united by the membrane throughout the greater part of their length, and smooth, without sensory papillæ. Gonads on the right, 29, extending from the 15th to the 43d myotomes inclusive. Myotome formula 44 + 9 + 13 = 66. Length ½ inch. Adult and young swimming at the surface in the evening in June and July at Bemini and Nassau, Bahamas; also taken buried in calcareous sand. (*Andrews.*) (*Lucayas*, the islands discovered by Columbus in 1492, now the Bahamas.)

*Asymmetron lucayanum*, Andrews, *l. c.*, 237, 1893, Bemini, Bahamas.

## Class II. MARSIPOBRANCHII.‡

(The Lampreys.)

Skeleton cartilaginous; the skull imperfectly developed, not separate from the vertebral column. No true jaws, no limbs, no shoulder girdle, no pelvic elements, no ribs. Gills in the form of fixed sacs, without branchial arches, 6 or more in number on each side. Nostril single, median. Mouth subinferior, suctorial, more or less circular. Heart without arterial bulb. Alimentary canal straight, simple, without cæcal appendages, pancreas, or spleen. Generative outlet peritoneal. Vertical fins with feeble rays, usually continuous around the tail. Naked, eel-shaped animals, inhabiting cool waters, both fresh and salt. They undergo a metamorphosis, the young being often quite unlike the adult. (Subclass CYCLOSTOMI, Günther, Cat., VIII, 1870, 499–512.) (*μαρσίπιον*, pouch; *βράγχια*, gills.)

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* Closely allied to this species is *B. elongatum*, Sundevall. Myocommata 49 + 18 + 12 = 79. Length 1½ to 2½ inches. Chinchas Islands, Peru, probably extending northward to Panama, but not yet recorded within our limits. (Sundevall, Ölfers. Vet. Akad. Förh., 147, 1853, Chinchas Islands.)

† *Epigonichthys* is said to differ from *Branchiostoma* in the absence of the anal fin. Dr. Andrews states that Mr. Arthur Willey, who has examined its Australian type, *E. cultellus*, finds gonads on the right side only, as in *Asymmetron*. If *Asymmetron* is a valid genus, probably *Epigonichthys* is also valid. It is perhaps distinguishable from *Asymmetron* by the want of a caudal process.

‡ Prof. Cope makes the *Marsipobranchii* a subclass under a class *Agnatha*, characterized by the absence of jaws and shoulder girdle. This class is composed chiefly of extinct forms, most of them belonging to the subclass *Ostracodermi*, and provided with bony dermal plates and lateral limbs. See American Naturalist, October, 1889, 853. The group *Marsipobranchii* is also often known as *Cyclostomi*, as *Dermopteri*, and as *Myzontes*.

### ORDERS OF MARSIPOBRANCHII.

*a.* Nasal tube duct-like, with cartilaginous rings, penetrating the palate; gill openings remote from the head, opening directly into the pharynx; no eyes. HYPEROTRETI, B.

*aa.* Nasal duct a blind sac, not penetrating the palate; gill openings close behind the head, communicating with a common branchial passage which opens directly into the pharynx; eyes well developed in the adult. HYPEROARTII, C.

## Order B. HYPEROTRETI.*

### (THE HAGFISHES.)

Nostril tube-like, with cartilaginous rings, penetrating the palate, its position at the extremity of the head, over the mouth; snout with 8 barbels; mouth without lips; 1 median tooth on the palate and 2 comb-like series of teeth on the tongue. Branchial apertures at a great distance from the head; a series of mucous sacs along each side of the abdomen. Intestine without spiral valve. Eggs large, with a horny case provided with threads for adhesion. Marine lamprey-like animals, burrowing into the flesh of fishes, on which they feed. They may be referred to 2 families, differing mainly in the structure of the gill openings. (*ὑπερῴα*, palate; *τρητός*, perforate).

*a.* Branchial apertures 6 to 14 on each side, each leading by a duct to a branchial sac. HEPTATREMIDÆ, II.

*aa.* Branchial apertures single on each side, from which diverge ducts to 6 branchial sacs. MYXINIDÆ, III.

## Family II. HEPTATREMIDÆ.

### (THE BORERS.)

This family differs from the *Myxinidæ* chiefly in the structure of the branchial apparatus, there being 6 to 14 sacs on each side which receive water directly from the œsophagus, as in *Myxine*, but the emptying ducts, instead of passing backward and downward to a common external opening, as in *Myxine*, pass directly through the wall of the body, so that there are as many external openings as there are gill sacs. Species about 5, referable to 2 genera, inhabiting the colder parts of the Pacific, their habits similar to those of *Myxine glutinosa.* They fasten themselves on the gills or eyes or isthmus of large fishes, whence they work their way very rapidly into the inside of the body. They there devour all the flesh without breaking the skin, so that the fish is left a mere hulk of head, skin, and bones. (*Myxinidæ*, genus *Bdellostoma*, Günther, Cat., VIII, 511. The generic name *Heptatrema*, Duméril, has priority over *Bdellostoma.*)

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* For a general account of our species of *Hyperotreti*, see Putnam, Proc. Bost. Soc. Nat. Hist., 1873.

*a.* Gill openings 10 to 12 on each side; base of tongue opposite sixth or seventh pair of gills.
POLISTOTREMA, 3.

## 3. POLISTOTREMA, Gill.

*Polistotrema*, GILL, Proc. U. S. Nat. Mus., 1880, 30, (*dombey*).*

This genus is distinguished from *Heptatrema (Bdellostoma)* by the presence of 10 to 14 gill openings, instead of 6 or 7, as in *Heptatrema.* Two or 3 species known, from the eastern Pacific. (A superlative of *πολύς*, many; *τρῆμα* aperture.)

### 5. POLISTOTREMA STOUTI, (Lockington).

(CALIFORNIA HAGFISH; LAMPERINA.)

Gills usually† 12 on each side, the number varying from 10 to 14. Teeth 10 in each series. Branchial artery dividing opposite sixth or seventh pair of gills. Snout 20 times in total length; head to first gill opening 4½; branchial region 8, tail 8. Plum color, paler below, the edge of the lower fold pale. Skin thin, very lax, and separable from the muscles, excessively slimy. L. 14 inches. Coast of California, and north to Cape Flattery, very abundant about Monterey, burrowing ‡ into the flesh of the larger flounders and *Sebastodes.* (Named for Dr. A. B. Stout, of San Francisco.)

*Bdellostoma stouti*, LOCKINGTON, Amer. Nat., 1878, 793, Eel River, California.
*Bdellostoma dombey*, JORDAN & GILBERT, Synopsis, 57, 1883, not of Cuvier.

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* *Polistotrema dombey* (Cuvier) is a species distinct from *P. stouti.* It is thus characterized by Putnam (Proc. Bost. Soc. Nat. Hist., 1873, 160), from specimens from Chile: "Head about ⅓ of total length, and contained about 1½ times in the length of the abdomen. Tail 7 to 8 times in total length. Base of tongue between the 7th or 8th pair of gills. Gills, 10 on each side. Length from 13 to 22 inches. Coast of Chile." According to Putnam the branchial artery divides at its base into a right and a left trunk in this species.
*Le Gastrobranche dombey*, LACÉPÈDE, Hist. Nat. Poiss., I, 531, 1798, Chile, non-binomial.
*Gastrobranchus dombey*, CUVIER, Règne Animal, 121, 1817, after Lacépède.
*Bdellostoma polytrema*, GIRARD, Proc. Acad. Nat. Sci. Phila., 1854, 199, Valparaiso.
*Bdellostoma polytrema*, GÜNTHER, Cat., VIII, 512, 1870.

†According to Dr. Gilbert, in 54 specimens of *Polistotrema stouti*, 41 were found to have 12 gill openings on each side, 12 had 11 on each side, and 1 had 13. Occasional specimens may have either 10 or 14, but the normal number is 12.

‡ The hagfish fastens itself usually on the gills or isthmus of large fishes, sometimes on the eyes, whence it works its way very rapidly into the inside of the body. It then devours all the flesh of the body without breaking the skin, so that the fish is left a living hulk of head, skin, and bones. It is especially destructive to fishes taken in gill nets. In every gill net in summer, at Monterey, more or less of these empty shells of fishes are obtained. When these are taken from the water the hagfish scrambles out with great alacrity. It is thought that the hags enter the fishes after they are caught. A fish of 10 to 15 pounds weight will be devoured by them in a single night. Large fishes of even 30 pounds weight are often brought up without flesh and without viscera, and they certainly do not swim into a gill net in this condition.
The fishes chiefly infested are *Sebastodes pinniger*, *miniatus*, and *mystinus*, *Ophiodon elongatus*, *Paralichthys californicus*, and *Rhacochilus toxotes.*

## Family III. MYXINIDÆ.

### (The Hagfishes.)

Body eel-shaped, covered by a thin skin, which is easily detached. Along the lower side, for nearly the whole length of the animal, are 2 rows of mucous glands, each with an external opening, yielding an abundance of mucus which renders these animals excessively slimy. No eyes. Brain small, of the normal fish type. Skull little developed, cartilaginous; the flexible notochord inclosed in its sheath, and extending from the base of the skull to the end of the tail, representing the spinal column. Mouth round, suctorial, without lips, with a pair of barbels on each side. Nostril single, large, on the median line above, and at the very front of the head, provided with 2 pairs of barbels. Teeth strong, a single median one on the roof of the mouth, and 2 rows on each side of the tongue, which is a powerful organ, with a strong fibrous tendon moving in a muscular sheath. Alimentary canal a simple nearly straight tube, without spiral valve; gill sacs placed on each side of the œsophagus, lying directly against its outer walls. The water passes into them by a small pore opening directly from the œsophagus into each sac. It is then passed out by a duct, which continues backward along the outer walls of the sacs to the abdominal wall at the end of the last sac, where all the ducts from one side unite in one, and the water is emptied at the branchial opening on each side of the median line. In close connection with the branchial opening on the left side there is a third opening that leads by a very short duct to the œsophagus, and hence into the branchial sacs, at the times when the supply of water through the mouth is cut off by the head being buried in the flesh of the animal on which it feeds. Ovary single, on the right side. No oviducts; the mature eggs falling into the abdominal cavity and excluded through the peritoneal opening at the side of the vent. Eggs with a horny case, and threads for adhesion. Parasitic animals, burrowing into the bodies of fishes, and found in the cold seas.

Two species are usually recognized—*Myxine olivacea*, Lacépède (= *australis*, Jenyns), from the coasts of Patagonia, and *Myxine glutinosa*. (*Myxinidæ*, genus *Myxine*, Günther, VIII, 510–511.)

### 4. MYXINE, Linnæus.

*Myxine*, Linnæus, Systema Naturæ, Ed. x, 1758, 650, (*glutinosa*).
*Gastrobranchus*, Bloch, Ichth., XII, 51, tab. 413, 1797, (*cœcus*).
*Muræenoblenna*, Lacépède, Hist. Nat. Poiss., v, 647, 1803, (*olivacea*).
*Anopsus*, Rafinesque, Anal. de la Nature, 493, 1815, (*olivacea*).

Characters of the genus included above. (An old name, from *μύξα*, slime).

#### 6. MYXINE GLUTINOSA,* Linnæus.

(Hagfish; Borer.)

Head 3½ to 4 in total length; tail 6½ to 10; lingual teeth 8 to 11 in each row. Bluish above, whitish below. North Atlantic on both coasts, south to Cape Cod. Not abundant in America. "Intrat et devorat Pisces; aquam in gluten mutat." (Linnæus). (Eu.)

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* "*Myxine* is generally or always in its young stage a male, while at a more advanced stage it becomes transformed into a female. It seems to be an animal which in sexual respects is in a transition stage, from what and to what it is hard to say. It seems to be seeking, without yet reaching that mode of reproduction which is most profitable for it in the struggle for existence." —*Fridtjof Nansen.*

*Myxine glutinosa*, Linnæus, Syst. Nat., Ed. x, 650, 1758, Atlantic Ocean; Günther, Cat., viii, 510, 1870; Putnam, Proc. Bost. Soc. Nat. Hist., 1873, 135.

*Myxine limosa*, Girard, Proc. Ac. Nat. Sci. Phila., 1858, 223, Grand Menan, Bay of Fundy; Jordan & Gilbert, Synopsis, 5, 1883.

*Gastrobranchus cœcus*, Bloch, Ichth., xii, pl. 413, 66, 1795, Denmark, etc.

## Order C. HYPEROARTII.*

### (The Lampreys.)

Nasal duct a blind sac, not penetrating the palate. This order is equivalent to the single family *Petromyzonidæ*. (*ὑπερῴα*, palate; *ἄρτιος*, complete; *i. e.*, entire.) (Petromyzontidæ, Günther, Cat., viii, 499–509.)

## Family IV. PETROMYZONIDÆ.

### (The Lampreys.)

Body eel-shaped, subcylindrical anteriorly, compressed behind; the mouth nearly circular, suctorial, usually armed with horny teeth, or tooth-like tubercles which are simple or multicuspid, resting on papillæ; those immediately above and those immediately below the œsophagus more or less specialized; eyes developed in the adult; gill openings 7, arranged in a row along the sides of the "chest;" nostril on top of the head just in front of the eyes; lips present, usually fringed; dorsal fin more or less deeply divided by a notch; the posterior part commonly continuous with the anal around the tail; intestines with a spiral valve; eggs small.

These animals undergo a metamorphosis; the young are usually toothless and have the eyes rudimentary. Separate generic names (*Ammocœtes*, *Scolecosoma*, *Chilopterus*) had been applied to these larval forms, before it was discovered that they were the normal young of the true lampreys.

Genera about 7; species about 15; of the rivers of temperate regions. They attach themselves to fishes and feed by scraping off the flesh with their rasp-like teeth. Most of them ascend rivers or brooks at the spawning season, after which very many of the individuals die. (Petromyzontidæ, Günther, Cat., viii, 499–509.)

*a.* Second dorsal continuous with caudal.
  *b.* Supraoral lamina ("maxillary") and infraoral lamina ("mandible") destitute of teeth, "the armature of the lamprey type being obsolescent;" otherwise as in *Petromyzon;* sea lampreys. Bathymyzon, 5.
  *bb.* Supraoral and infraoral laminæ with teeth or tooth-like tubercles.
    *c.* Supraoral lamina contracted, the armature consisting of 2 or 3 cusps placed close together; discal teeth numerous, in concentric series; anterior lingual teeth with a median depression or groove; buccal disk large in the adult, contracted in the young.
      Anterior lingual tooth with a deep median groove and terminating in an incurved point; dorsal fin divided. Large lampreys; anadromous. Petromyzon, 6.

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* For a detailed account of the North American Lampreys, see Jordan & Fordice, Ann. N. Y. Ac. Sci., 1886. For an excellent account of the life history of certain species see Gage, in Wilder Quarter-Century Book, 1893, pp. 420–479.

*dd.* Anterior lingual tooth divided by a median groove; dorsal fin continuous, with a broad notch. Small lampreys; fluviatile. ICHTHYOMYZON, 7

*cc.* Supraoral lamina very large, expanded laterally, forming a crescent-shaped plate with a cusp at either end and sometimes a median cusp; anterior lingual teeth more or less serrate.

*e.* Supraoral lamina with a well-developed median cusp; anterior lingual tooth wedge-shaped, its edge finely serrate and nearly straight; dorsal fin divided; buccal disk moderate, some of its teeth bicuspid. Large lampreys; anadromous. ENTOSPHENUS, 8.

*ee.* Supraoral lamina with a very small median cusp or none; anterior lingual tooth little developed, its edge crescent-shaped and dentate; the middle denticle enlarged; buccal disk small, the teeth small and never tricuspid; dorsal fins separate or deeply divided; small lampreys; fluviatile. LAMPETRA, 9.

## 5. BATHYMYZON, Gill.

*Bathymyzon*, GILL, Proc. U. S. Nat. Mus., 1883, 254, (*bairdii*).

Supraoral lamina contracted, its two converging teeth almost completely fused, and only evident at the summit of the combined mass; infraoral lamina crescentiform and spout-like at the middle and with the denticles obsolete; discoperipheral teeth numerous and in obliquely arched series of 4 to 7, declining downward; innermost lateral teeth of the 4 rows diverging from mouth, in each side bicuspid, with the cusps approximated and diminishing downward rapidly; lingual teeth 3, pectinate, the anterior deeply impressed and sulcate backward at the middle, and the posterior correspondingly curved backward at their inner lateral angles; the anterior dorsal fin distinct from posterior. (*βαθύς*, deep; *μύζω*, to suck.)

### 7. BATHYMYZON BAIRDII, (Gill).

Head from snout to first branchial aperture about 7 times in total length; eye midway between snout and fifth branchial aperture; diameter of buccal disk equal to interval between eye and fifth branchial aperture, the margin regularly fringed; indications of 8 teeth on the infraoral lamina; tips of the two supraoral ones barely perceptible; pectinations of lingual teeth well marked. Chest about as long as snout. Fins moderate; anterior dorsal somewhat higher in front of middle than diameter of orbit, second dorsal about twice as high, or equal to the distance between eye and first branchial aperture. Color dark, belly grayish; second dorsal darker across middle in front and toward margin behind; caudal blackish throughout. (Gill.) Gulf stream, once taken. (Named for Spencer Fullerton Baird.)

*Petromyzon* (*Bathymyzon*) *bairdii*, GILL, *l. c.*, 254, 1883; lat. 49° N., 547 fathoms; GOODE & BEAN, Oceanic Ichthyology, 4, 1894. (Type, No. 33311.)

## 6. PETROMYZON, (Artedi), Linnæus.

### (LAMPREYS.)

*Petromyzon*, (ARTEDI), LINNÆUS, Systema Naturæ, Ed. x, 1758, 230 (*marinus*).

*Ammocœtes*, (Duméril), CUVIER, Règne Animal, Ed. I, 119, 1817, (*branchialis*, larval form of any or all European species.)

*Ammocœtus*, BLAINVILLE, Faune Française, liv. XXIV, 3, 1828, (*branchialis*).

Lampreys with the supraoral lamina armed with 2 or 3 separate teeth, pointed, and close together, not forming a crescent-shaped plate; anterior lingual tooth with a median depression; buccal disk large, with numerous teeth arranged in concentric series; dorsal fins separate, the second joined to the caudal.

North Atlantic, ascending rivers; one species known, the largest of the lampreys. (*πέτρα*, stone; *μύζω*, to suck.)

### 8. PETROMYZON MARINUS, Linnæus.

(Great Sea Lamprey; Lamprey Eel.)

Head large, longer than the branchial area; buccal disk large, with numerous conical teeth, arranged in obliquely transverse series, 4 to 7 in each row; lateral teeth on each side of mouth bicuspid, the other teeth simple; dorsals low, well separated; the second dorsal with a depression on the tail; lips moderately fringed; males and often females, in spring, with an elevated fleshy ridge on back before dorsal fin; 64 muscular impressions between gill openings and vent. Color bluish brown, mottled with blackish confluent patches, rarely nearly plain; whitish below. Length 24 to 36 inches. Atlantic coasts of Europe and North America, southward to Chesapeake Bay, abundant northward, ascending streams in the spring to deposit its spawn. (Eu.)

*Petromyzon marinus*, Linnæus, Syst. Nat., Ed. x, 1758, 230, European Seas; (after Artedi); Günther, Cat., viii, 501; Jordan & Gilbert, Synopsis, 11, 1883; Jordan & Fordice, Ann. Ac. Sci. N. Y., 1886, 283.

*Petromyzon americanus*, Le Sueur, Trans. Am. Phil. Soc. Phila., i, 383, 1818, Coast of Massachusetts; Storer, Fish. Mass., 251, pl. 38, fig. 4, 1867.

*Petromyzon nigricans*, Le Sueur, *l. c.*, 385, 1818, Massachusetts.

*Ammocœtes bicolor*, Le Sueur, *l. c.*, 386, 1818, (larva), Northampton, Massachusetts.

*Petromyzon appendix*, De Kay, N. Y. Fauna: Fishes, 381, 1842, (young). Providence; Hudson River.

? *Petromyzon lamotteni*, Le Sueur, in De Kay, *l. c.*, 382, 1842, no locality.

Represented in fresh waters by

### 8a. PETROMYZON MARINUS UNICOLOR, (De Kay).

A dwarfish form similar to the common lamprey; darker and more uniform in color, the dorsal ridge larger, the fins closer together; found landlocked in the lakes of northern and central New York; abundant in Cayuga Lake.

*Ammocœtes unicolor*, De Kay, N. Y. Fauna: Fishes, 383, 1842, (larva), Lake Champlain.

*Petromyzon marinus dorsatus*, Wilder MS., Jordan & Gilbert, Synopsis, 869, 1883, Cayuga Lake. (Type, No. 31368); Gage, Wilder Quarter Century Book, 1893, 420.

*Petromyzon marinus unicolor*, Meek, Ann. Ac. Sci. N. Y., 1886, 284.

## 7. ICHTHYOMYZON, Girard.

(River Lampreys.)

*Ichthyomyzon*, Girard, Pac. R. R. Sur., x, 381, 1858, (*argenteus*).

*Scolecosoma*, Girard, *l. c.*, 385, 1858, (*concolor*, *larva*).

Allied to *Petromyzon*, but with the anterior lingual tooth divided by a median groove. Dorsal fin continuous, with a broad notch. Small lampreys; confined to fresh waters in eastern United States. (*ἰχθύς*, fish; *μύζω*, to suck.)

*a.* Head 7½ in length; infraoral lamina with 7 cusps. CONCOLOR, 9.
*aa.* Head 9 in length; infraoral lamina with 7 to 12 cusps. CASTANEUS, 10.

### 9. ICHTHYOMYZON CONCOLOR, (Kirtland).

(SILVERY LAMPREY.)

Body considerably compressed; head broad, with large buccal disk, which is moderately fringed; teeth strong and nearly uniform, the 2 supraoral teeth being similar to those on the rest of the disk; lateral teeth all simple; infraoral cusps connivent, 7 in number, the middle ones the longest; upper margin of dorsal scarcely depressed in front of the vent; origin of dorsal nearly midway between the tip of snout and end of tail; 51 muscular impressions between gill openings and vent. Head 7½; depth 12. Color, silvery, bluish above, sometimes with bluish spots; a small dusky spot above each gill opening, usually conspicuous even in the larva; larva with small toothless contracted mouth, as in *P. marinus*. It may be that this is the young of *Petromyzon marinus*. L. 12 inches. Great Lakes and upper Mississippi Valley; rather common; ascending small brooks in the spring. (*concolor*, uniformly colored.)

*Petromyzon argenteus*, KIRTLAND, Bost. Jour. Nat. Hist., III, 1840, 342, with plate (name preoccupied), Big Miami River.
*Ammocœtes concolor*, KIRTLAND, *l. c.*, 473, with plate (larva), Mahoning River; Scioto River.
*? Ammocœtes borealis*, AGASSIZ, Lake Superior, 252, 1850, Michipicoten River.
*? Ammocœtes æpyterus*, ABBOTT, Proc. Ac. Nat. Sci. Phila., 1860, 327 (larva), Ohio River.
*Petromyzon bdellium*, JORDAN, Cat. Fish. N. A., 4, 1885, after Kirtland.
*Petromyzon concolor*, JORDAN & FORDICE, Ann. N. Y. Ac. Sci., 1886, 282.
*Ichthyomyzon argenteus*, JORDAN & GILBERT, Synopsis, 10, 1883.

### 10. ICHTHYOMYZON CASTANEUS, Girard.

Supraoral lamina tricuspid; some of the lateral teeth bicuspid; infraoral lamina with 7 to 12 cusps; head 9 in length; otherwise as in *I. concolor*, the color more yellowish. L. 12 inches. Mississippi Valley, scarce.* (*castaneus*, chestnut color.)

*Ichthyomyzon castaneus*, GIRARD, Pac. R. R. Surv., 381, 1858, Galena, Minnesota.
*Ichthyomyzon hirudo*, GIRARD, *l. c.*, 382, Fort Smith, Arkansas. (Type, No. 980.)
*Petromyzon castaneus*, JORDAN & GILBERT, Synopsis, 868, 1883, and JORDAN & FORDICE, *l. c.*, 281, 1886; GÜNTHER, Cat., VIII, 507, 1870.
*Ichthyomyzon hirudo*, GÜNTHER, Cat., VIII, 507, 1870.

## 8. ENTOSPHENUS, Gill.

*Entosphenus*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 331, (*tridentatus*, name only); JORDAN & GILBERT, Synopsis, 7, 1883 (*tridentatus*).

Lampreys of large size, with the supraoral lamina forming a crescent-shaped plate on which are 3 cusps, the middle one little smaller than the others; anterior lingual tooth wedge-shaped, its edge almost straight and finely pectinate; lips fringed; buccal disk moderate, its teeth comparatively few; dorsal fins separate. One species, a large anadromous lamprey, found in the North Pacific, similar in habit to *Petromyzon marinus* of the North Atlantic. (*ἐντός*, within; *σφήν*, wedge; the lingual tooth being wedge-shaped.)

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*Recorded from Galena, Minn. (Girard); Mill Creek, Shawnee Co., Kans. (Cragin); Fort Smith, Ark. (Girard); Forlorn Hope, La. (Bean); Manitoba (Evermann).

### 11. ENTOSPHENUS TRIDENTATUS, (Gairdner).

Lips thick, fringed with numerous papillæ, within which are small teeth. Infraoral lamina with 5 or 6 cusps; buccal teeth before mouth unicuspid, those on sides larger, the first and last bicuspid, the middle ones tricuspid; median supraoral cusp little more than ½ the length of the other 2; first dorsal fin distant about ⅖ of its own length from the second. Head 8 to 10 in length; 73 muscular impressions between gill openings and vent. Color, plain dark brown, rarely mottled. Pacific coast of America, Unalaska to Southern California; ascending streams to spawn, going as far as Walla Walla, in the Columbia, its range southward extends to Santa Ana River at Riverside, California. L. 18 inches or more. (*tridentatus*, three-toothed.)

*Petromyzon tridentatus*, (GAIRDNER MS.), RICHARDSON, Fauna Bor. Am., 293, 1836, Falls of the Walamet, now Willamette.

*Petromyzon ciliatus*, AYRES, Proc. Cal. Ac. Sci., 1855, 44, San Francisco.

*Petromyzon lividus*, GIRARD, Pac. R. R. Surv., 379, 1858, Wahlahmath River, Oregon (Willamette River.) (Type, No. 976.)

*Petromyzon astori*, GIRARD, *l. c.*, 380, 1858, Astoria, Oregon. (Type, No. 978.)

*Ichthyomyzon tridentatus* and *astori*, GÜNTHER, Cat., VIII, 506, 1870.

*Entosphenus epihexodon*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 331, Fort Reading, California after Girard.

*Lampetra tridentata*, *astori*, and *epihexodon*, JORDAN & GILBERT, Synopsis, 7, 8, 1883.

*Ammocœtes tridentatus*, JORDAN & FORDICE, *l. c.*, 291, 1886.

## 9. LAMPETRA,* Gray.

### (BROOK LAMPREYS.)

*Lampetra*, GRAY, Proc. Zoöl. Soc. London, 1851, 235, (*fluvialis*).

Lampreys of small size, with the dorsal fin emarginate or divided into two parts, the posterior portion continuous with the low anal fin around the tail; supraoral lamina broad, forming a crescentic plate, with a large bluntish cusp at each end, and rarely a very small median cusp; lingual teeth small, with a crescent-shaped dentate edge, the median denticle enlarged; buccal disk small, its teeth few and never tricuspid. Small lampreys, inhabiting the brooks of Europe and North America. Five or 6 species known, bearing much the same relation to *Entosphenus* that *Ichthyomyzon* bears to *Petromyzon*. (*lambere*, to suck; *petra*, stone.)

*a.* Dorsal fin divided into 2 parts which are separate, or joined at base only.

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* The name *Ammocœtes* was originally applied to the larval forms of *Petromyzonids* which are in that stage specifically indistinguishable and which were supposed by Duméril and Cuvier to be generically distinct from the adult forms. After the identity of the two was discovered, the name *Ammocœtes* was used by many writers, following a suggestion of Milne-Edwards, as a general term to be applied to the blind or larval stage of all lampreys. *Lampetra* of Gray should therefore be used for this genus, for which it was originally proposed. Inasmuch as no European *Ammocœtes* can be referred to any determinate species of *Petromyzonid*, the nominal genus corresponds with *Petromyzon* as a whole and not to any subdivision.

*b.* Infraoral lamina with 7 cusps; dorsals wholly separate. AUREA, 12.
*bb.* Infraoral lamina with 8 or 9 cusps.
  *c.* Lateral teeth usually 4 on each side, all bicuspid; dorsals separate. SPADICEA, 13.
  *cc.* Lateral teeth usually 3 on each side of disk, the middle one tricuspid, the others bicuspid; dorsals slightly connected. CIBARIA, 14.
*aa.* Dorsal fins distinctly united, with a sharp notch; lateral teeth usually 3, bicuspid. WILDERI, 15.

### 12. LAMPETRA AUREA, (Bean).

Dorsal fins separate, the first ½ the height of the second, the interspace ⅔ the length of the first; infraoral lamina with 7 cusps, the outer largest; head shorter than thorax, 10½ in length. Plumbeous, golden below. (*Bean.*) Yukon River and streams of Alaska and Kamchatka. L. about a foot. Very close to the European *L. fluviatilis.* (*aureus*, golden.)

*Ammocœtes aureus*, BEAN, Proc. U. S. Nat. Mus., 1881, 159, Yukon River; (Type, No. 21524); JORDAN & GILBERT, Synopsis, 868, 1883.

*Lampetra camtschatica*, PALLAS, Zoogr. Rosso-Asiat., III, 67, 1811, Kamchatka. This was apparently not intended as a binomial name.

? *Petromyzon borealis*, GIRARD, Pac. R. R. Surv., 377, 1858, after *P. fluvialis*, Richardson, mentioned only as a small lamprey attached to an Inconnu in Great Slave Lake, "very like Bloch's figure" of *L. fluviatilis.*

### 13. LAMPETRA SPADICEA, Bean.

Dorsals separated, the interspace ½ the snout, insertion of first at middle of body; second dorsal little higher than first; infraoral lamina with 9 cusps, the outer largest; lingual teeth with about 20 pectinæ; 4 bicuspid teeth on each side of disk. Guanajuato, Mexico. (*Bean.*) (*spadiceus*, nut-brown.)

*Lampetra spadicea*, BEAN, Proc. U. S. Nat. Mus., 1887, 374, Guanajuato, Mexico. (Type, No. 38005.)

### 14. LAMPETRA CIBARIA, (Girard).

Lips fringed; infraoral lamina with 8 or 9 subequal cusps; about three teeth on each side of buccal disk, the middle one usually tricuspid, the others bicuspid; teeth on upper part of disk simple; dorsal fins slightly connected at base; second dorsal not much higher than first, much lower than in *L. wilderi;* insertion of dorsal a little behind middle of body; 63 muscular depressions between last gill opening and vent; head 10 in length. Color plumbeous, sides silvery. L. 8 inches. Pacific slope, from Fraser River to the Sacramento. Rather common in the rivers and brooks northward. (*cibarius*, pertaining to food.)

*Petromyzon plumbeus*, AYRES, Proc. Cal. Ac. Sci., 1854, 28, (name preoccupied), San Francisco.

*Ammocœtes cibarius*, GIRARD, Pac. R. R. Surv., 383, 1858, larva, Puget Sound; JORDAN & FORDICE, *l. c.*, 292, 1886. (Type, No. 6176.)

*Petromyzon ayresi*, GÜNTHER, Cat., VIII, 505, 1870, British Columbia.

*Lampetra plumbea*, JORDAN & GILBERT, Synopsis, 8, 1883.

### 15. LAMPETRA WILDERI, Gage, new species.

(SMALL BLACK LAMPREY.)

Head moderate, about as long as the thorax; mouth small; snout shorter and lips, less fringed than in *L. planeri;* dorsal fins connected only in breeding season, inserted behind middle of body, considerably depressed in front of the vent, but not divided into 2 fins; posterior lobe highest;

insertion of dorsal a little before middle of body; both dorsals high, the first 1¾ in height of second; anal tube conspicuous in the spring; eyes moderate; supraoral lamina with its cusps large, triangular, well separated; a small pointed median cusp sometimes present in the adult; in half-grown specimens the lamina forms a curved plate without distinct cusps; infraoral lamina curved, with 5 to 9 feeble, bluntish, subequal cusps; about 3 bicuspid teeth on each side of mouth; other buccal teeth simple. Head 8½; 67 muscular impressions between gill openings and vent. Bluish black above, silvery below. L. 6 to 10 inches. A small species ascending western streams in the spring in great numbers to deposit its spawn; abundant from Western New York (Cayuga Lake; Meek, Gage) to Iowa, both in tributaries of the Great Lakes and the Ohio and Mississippi. Our species seems to be distinct from *Lampetra planeri*, generally common in Northwestern Europe. (Named for Burt Green Wilder, the distinguished anatomist, the first to study the lampreys of Cayuga Lake. Specimens from that locality are taken as types of *L. wilderi.*)

*Petromyzon nigrum*, Rafinesque, Ich. Oh., 84, 1820, (name preoccupied), Falls of Ohio.
*Petromyzon branchialis*, Günther, Cat., viii, 504, 1870.
*Ammocœtes niger*, Jordan & Gilbert, Synopsis, 9, 1883.
*Ammocœtes branchialis*, Jordan & Fordice, *l. c.*, 293, 1886. Gage, in Wilder Quarter-Century Book, 436, 1893.

## Class III. PISCES.

### (The Fishes.)

The Pisces, or Fishes, may be defined as cold-blooded vertebrates adapted for life in the water, breathing by means of gills which are attached to bony or cartilaginous gill arches, the gills persistent throughout life; having the skull well developed and provided with a lower jaw; the limbs present and developed as fins, rarely wanting through atrophy; shoulder girdle present, furcula-shaped, curved forward below, rarely obsolete or represented by cartilage; pelvic bones present; exoskeleton developed as scales or bony plates or horny appendages or sometimes entirely wanting, and with the median line of the body provided with one or more fins composed of cartilaginous rays connected by membrane, the fins rarely atrophied.

All recent writers on fishes agree that the Lancelets and the Lampreys differ so widely in structure and development from the true fishes that they must be regarded as forming distinct classes. Many writers go still further, and remove from the class of fishes the Sharks, Skates, Chimæras and Dipnoans. A smaller number remove the Ganoids, also. It seems to us, however, preferable to regard these, with the True Fishes, or Teleosts, as members of the single class of Pisces.

The class Pisces may be conveniently divided into 5 subclasses—Selachii, Holocephali, Dipnoi, Crossopterygia, and Teleostomi. As there are no North American representatives of the Dipnoi (Ceratodus, Lepidosiren, Protopterus), or of the Crossopterygia (Polypterus), these singular groups may be passed by without further mention in this work.

### SUBCLASSES OF PISCES.

*a.* Skull without system of membrane bones (opercles, etc.).

*b.* Suspensorium of the mandible present. Gills not free, being attached by the outer margin to the skin; eggs few and large, impregnated and sometimes developed internally, covered with a thick leathery skin when developed externally; embryo with deciduous external gills; no membrane bones about the head; upper jaw formed of palatine and pterygoid elements without maxillary or premaxillary; skeleton cartilaginous; skull without sutures; tail heterocercal; ventral fins abdominal; male with large intromittent organs or claspers attached to the ventral fins, these complex in structure in existing species; shoulder girdle not attached to the skull; skin naked or covered with small rough scales, or spines, or bony bucklers; no air bladder; arterial bulb with 3 series of valves; optic nerves with a chiasma; cerebral hemispheres united; gill openings slit-like, 5 to 7 in number; jaws distinct from the skull, joined to it by suspensory bones; teeth distinct. (Sharks and Skates.) SELACHII.

*bb.* Suspensorium of the mandible wanting; no maxillary arch; ventral fins with claspers; gill opening single, leading to 4 gill slits; jaws coalescent with the skull; teeth united in the form of bony plates. (Chimæras.) HOLOCEPHALI.

*aa.* Skull with a well-developed system of membrane bones (opercles, suborbital ring, etc.); gills free, attached to the gill arches by their bases only; gill opening single on each side; eggs comparatively small and numerous; no claspers; a maxillary arch; cerebral hemispheres not united. (True Fishes.) TELEOSTOMI.

## Subclass SELACHII.*

### (THE SHARKS AND SKATES.)

This group, sufficiently defined above, includes among recent fishes, the Sharks and the Rays, marine fishes mostly of large size, abounding in all seas. The group is commonly divided into 2 orders, which are widely different in appearance, so far as the extremes are concerned, but which pass into each other by insensible gradations.

We begin the group with the archaic type, the order or suborder *Diplospondyli*, proceeding thence from the more generalized sharks to the specialized skates. The true sharks form an almost perfect gradation into the skates, but there are no forms extant which connect the *Diplospondyli* with modern sharks. (*σέλαχος*, shark; the word originally meaning cartilage.)

### ORDERS OF SELACHII.

*a.* Gill openings 6 or 7; dorsal fin single; vertebral column imperfectly segmented, each segment being equivalent to 2 vertebræ, and bearing 2 neural aches; anal fin present. DIPLOSPONDYLI, D.

*aa.* Gill openings 5; vertebral column well segmented, each segment forming a neural arch and 1 centrum.

*b.* Vertebræ each with the internal calcareous lamellæ radiating from the central ring; anal fin present. ASTEROSPONDYLI, E.

*bb.* Vertebræ with the internal calcareous lamellæ not radiating, but arranged in one or more concentric circles or series around the central ring; no anal fin; palatoquadrate arch not articulated to the skull.

*c.* Gill openings lateral; dorsal fins 2. CYCLOSPONDYLI, F.

*cc.* Gill openings ventral; dorsal fins small and posterior, or wanting; body and pectoral fins forming a depressed disk. BATOIDEI, G.

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* Also frequently known as *Elasmobranchii*, *Plagiostomata*, *Chondropterygia*, or *Placoidei*. In Prof. Cope's system, the *Selachii* constitute one of the 2 orders in this subclass and all the existing sharks and skates are referred to it. In the *Selachii*, as thus understood, the claspers are complex, while in the extinct order of *Ichthyotomi* these organs are simple.

## Order D. DIPLOSPONDYLI.

### (The Notidanoid Sharks.)

Sharks with the palatoquadrate apparatus articulated or connected with the postorbital processes of the skull; branchial apertures in increased number, 6 or 7: only 1 dorsal fin. Vertebral column imperfectly segmented so that from each segment 2 neural arches and 2 vertebral bodies arise. Among existing sharks this group contains 2 families. Numerous genera represented by fossils seem allied to these, which are among the "oldest living vertebrates." (*διπλόος*, double; *σπόνδυλος*, vertebra; *Notidanus*, (*νωτιδανός*, dry back) is a Greek name of some shark, in Atheneus.)

*a.* Body greatly elongate, almost eel-shaped; dorsal, anal, and ventrals close together on posterior part of body; teeth in the 2 jaws alike; mouth anterior.
CHLAMYDOSELACHIDÆ, V.

*aa.* Body moderately elongate; teeth in the 2 jaws unlike; mouth inferior.
HEXANCHIDÆ, VI.

## Family V. CHLAMYDOSELACHIDÆ.

### (The Frilled Sharks.)

Body elongate, slender, suggesting the form of an eel. Head broad, depressed. Eyes lateral, without nictitating membrane. Nasal cavity separate from that of the mouth. Mouth anterior. Teeth with broad, backward-extended bases and slender cusps. Spiracles present. Gill openings 6. One dorsal fin, without spine; anal fin present. No pit at root of caudal. First gill membrane free across the isthmus. Intestine with a spiral valve. Anterior basibranchial cartilages present.

This family contains a single species, recently discovered by Mr. Garman, from whose papers this account is taken. It inhabits the open sea, and may not occur in American waters.

*Chlamydoselachidæ*, GARMAN, Bull. Essex Inst., 1884, 47, and elsewhere.

### 10. CHLAMYDOSELACHUS, Garman.

*Chlamydoselachus*, GARMAN, Bull. Essex Inst., Jan. 17, 1884, 47, (*anguineus*).

Opercular flap forming a broad frill over first gill opening. Teeth similar in both jaws, each with 3 slender, curved, subconical cusps, separated by a pair of rudimentary denticles, on a broad base; no median upper series of teeth in front; a series on the symphysis below. Mouth wide, without labial folds at the angles. Pupil horizontally elongate. Fins broad; caudal without a notch. Basihyal elongate. One species known, inhabiting waters of some depth in the open sea. An extinct species, *Chlamydoselachus lawleyi*, Davis, has been described from pliocene deposits in Tuscany. (*χλαμύς*, mantle or frill; *σέλαχος*, shark.)

#### 16. CHLAMYDOSELACHUS ANGUINEUS, Garman.

Dorsal fin small, opposite the anal, which is more than twice its size; pectorals small, placed low; ventrals large, placed far back, opposite anal. Eye small. Gill openings large, curved, oblique, all of them before pectorals. Teeth $\frac{13-0-13}{12-1-12}$. Scales on upper edge of tail enlarged. Head 7½ in length. Greatest depth of body about 15. Color, plain brown. L. 5 to 6 feet (*Garman*). Seas about Japan; also taken off Madeira, in deep water. Not certainly known from the American coast, but if fishermen's drawings can be trusted, this is found in the Western Atlantic and is probably the original of some of the recorded "sea serpents." (*anguineus*, from *anguis*, the slow worm, the word allied to *anguilla* = ἔγχελυς, eel.)

*Chlamydoselachus anguineus*, GARMAN, *l. c.*, and in Bull. Mus. Comp. Zoöl., 1885, XII, No. 1, with plates and account of anatomy, off Japan; GÜNTHER, Deep Sea Fishes, Challenger, 1884, with plates, Japan; COLLETT, Bull. Soc. Zoöl. France, 1890, 219; Funchal, Madeira.

## Family VI. HEXANCHIDÆ.

### (THE COW SHARKS.)

Body moderately elongate, somewhat depressed anteriorly, tapering toward the caudal fin. Head depressed, oblong, with the snout projecting. Eyes submedian or anterior, without nictitating membrane. Mouth subinferior, large, arched in front; no labial fold. Teeth in the 2 jaws unlike; in the upper jaw 1 or 2 pairs of awl-shaped teeth, the next 6 teeth broader and each provided with several cusps, one of which is much the strongest. Lower jaw with 6 large comb-like teeth on each side, besides the smaller posterior teeth. Spiracles small, on the side of the neck. Only 1 dorsal fin, without spine, opposite the anal, and similar to it. No pit at the root of the caudal. Gill openings wide, 6 or 7 in number. Viviparous sharks, sometimes reaching a very large size. Genera 3; species about 7; of the warm seas. (NOTIDANIDÆ, Günther, Cat., VIII, 397-399.)

*a.* Gill openings 7 on each side; median tooth of lower jaw with a small median cusp or none. NOTORHYNCHUS, 11.

*aa.* Gill openings 6 on each side; median tooth of lower jaw with a small median cusp or none. HEXANCHUS, 12.

### 11. NOTORHYNCHUS,* Ayres.

*Notorhynchus*, AYRES, Proc. Cal. Ac. Sci., 1856, I, 72, (*maculatus*).

Gill openings 7 on each side. Dentition in general much as in *Hexanchus*, the lower teeth uniform in size or decreasing toward corners of mouth; cusps on the cutting edge regularly graduated, while the ascending inner margin of each tooth is finely serrated; median tooth of lower jaw with the median cusp small or wanting. Two species known; spotted sharks of the Pacific. (νῶτος, back; ῥύγχος, snout; the allusion not clear.)

#### 17. NOTORHYNCHUS MACULATUS, Ayres.

Snout broad, rounded, the nostrils near its tip; spiracles large, nearer the gill openings than the eye; a long furrow at the angle of the mouth. No median tooth in upper jaw; 2 small teeth near together in front, simple and pointed; 2 a little larger, behind and outside of these;

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*In *Heptranchias cinereus*, the European type of *Heptranchias*, the lower median tooth has a strong central cusp.

then 2 others directly behind the first pair; next, on each side, a tooth much larger, pointed, with a conspicuous cusp on the outer side at base, and one or more denticulations beside; the other teeth larger, similar, but more serrated and more oblique, approaching the lower teeth in form; median tooth in lower jaw broad, with a small median cusp and 2 or 3 larger lateral cusps on each side; the other teeth, 6 on each side, much broader than high, with 4 to 6 sharp, outward-directed cusps, the first cusp longest and bearing a small tooth near its base; these teeth are quite similar and increase slightly in size outward. Tail long, 2¾ in total length, the caudal fin mostly below it; anal small, just behind the small dorsal. Sandy gray, with some round black spots, larger than the pupil, rather sparsely placed. Pacific coast, from Monterey northward to Washington; rather common northward, especially in Humboldt Bay. (*maculatus*, spotted.)

*Notorhynchus maculatus*, AYRES, Proc. Cal. Ac. Sci., 1856, 1, 72, San Francisco.
*Notorhynchus maculatus*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 495, and 1864, 149.
*Notorhynchus borealis*, GILL, Proc. Ac. Nat. Sci. Phila., 1864, 150, Nisqually, Washington.
*Heptranchias maculatus*, JORDAN & GILBERT, Synopsis, 62, 1883.

## 12. HEXANCHUS, Rafinesque.

*Hexanchus*, RAFINESQUE, Caratteri, 1810, 14, (*griseus*).
*Notidanus*, CUVIER, Règne Animal, Ed. 1, 1817, 128, (*griseus*).
*Monopterhinus*, BLAINVILLE, Faune Française, 1828, 77, (*griseus*).

Two species known, distinguished from all other living sharks except the eel-shaped *Chlamydoselachus*, by the presence of 6 gill openings. (*ἕξ*, six; *ἄγχος*, bend or sinus.)

*a.* Median tooth of lower jaw with a slight median cusp and about 3 marginal cusps; first lateral tooth with about 6 cusps. CORINUS, 18.
*aa.* Median tooth of lower jaw without median cusp, but with 4 or 5 marginal cusps; first lateral tooth with 8 or 9 cusps. GRISEUS, 19.

### 18. HEXANCHUS CORINUS, Jordan & Gilbert.

(SHOVEL-NOSED SHARK.)

Head large, broad, depressed, and blunt. No median tooth in upper jaw; about 4 pointed teeth in front of upper jaw; all entire and without basal cusps; the next 3 teeth with a single strong cusp on the outer margin; others with more cusps, approaching form of lower teeth; median tooth of lower jaw very small, with a small cusp; lateral teeth with 6 cusps, the first the largest, the others regularly smaller, the median edge in the adult finely serrated. Tail long, twice as long as head, about 3⅕ in total length. Pectoral as long as lower jaw from gill opening. Scales on upper edge of tail enlarged. Color almost black, unspotted; a grayish lateral streak. Monterey Bay to Puget Sound, not common. (*corinus*, northwestern, from *corus* or *caurus*, the northwest wind.)

*Hexanchus corinus*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1880, 352, Neah Bay; and Soquel and Bay of Monterey, California; Synopsis, 62, 1883. (Types, Nos. 37369, 27196.)

### 19. HEXANCHUS GRISEUS, (Gmelin).

(Cow Shark; Caña-Bota.)

Head large, depressed, blunt, the nostrils near tip of snout; no median upper tooth; 2 on each side entire, hooked outward; the next teeth with 6 or 7 cusps, the others similar; lower median tooth small, without cusp; lateral teeth each with 7 to 9 cusps, the number of denticles on most of the teeth being thus greater than in *H. corinus.* Tail not twice head, 3½ in length, its upper scales enlarged; pectoral shorter than lower jaw from gill opening. Color dark gray. (*Day*). L. 8 to 26 feet. A very large shark inhabiting deep water, in the Mediterranean, thence north to the west coasts of Scotland; also frequently taken in Cuba. (*Poey*). (*griseus*, gray.) (Eu.)

*Squalus griseus*, Gmelin, Syst. Nat., 1495, 1788, Mediterranean, after Broussonet.
*Squalus griseus*, Bonnaterre, Tabl. Encycl. Ichth., 9, 1788, Mediterranean, after Griset of Broussonet.
*Notidanus griseus*, Günther, Cat., VIII, 397, 1870.
*Notidanus griseus*, Day, British Fishes, 308, 1870.
*Hexanchus griseus*, Poey, Synopsis, 454, 1875.

## Order E. ASTEROSPONDYLI.

(The Typical Sharks.)

The essential character of this order is in the structure of the vertebræ. The calcareous lamellæ within each vertebra radiate from the central ring. The group contains the great body of living sharks, including all of those with 5 gill openings, 2 dorsals, and an anal fin. (*ἀστήρ*, star; *σπόνδυλος*, vertebra.)

### Suborders of Asterospondyli.

*a.* Palatoquadrate apparatus articulated to preorbital part of skull; dorsal fins with spines. Proarthri.
*aa.* Palatoquadrate apparatus not articulated with the skull; no dorsal spines. Galei.

## Suborder PROARTHRI.

(The Cestraciont Sharks.)

This group is characterized by the articulation of the palatoquadrate apparatus by an extensive surface with the preorbital region of the skull. Vertebræ asterospondylous. It consists of a single family, the Heterodontidæ, which, like the preceding families, possesses much interest to palæontologists from its supposed relation to extinct forms. (*πρό*, before; *ἄρθρον*, joint; *Cestracion*, is an old name, from *κέστρα*, a pickax; the name probably originally applied to *Sphyrna.)*

### Family VII. HETERODONTIDÆ.

(The Bullhead Sharks.)

Sharks with 2 dorsal fins, each provided with a strong spine; the first dorsal opposite the space between pectorals and ventrals; the second in advance of the anal. Body elongate, obtusely trihedral, gradually tapering backward; head high, with the forehead declivous, little prominent; nostrils confluent with mouth; mouth rather narrow, the upper lip divided into 7 lobes, the lower with a fold; spiracles small, below the lower part of the eye; no nictitating membrane; gill openings rather narrow; dentition similar in both jaws, small obtuse teeth in front, which in the young are pointed, and provided with 3 to 5 cusps; lateral teeth large, pad-like, twice as broad as long, arranged in oblique series, one series being formed by much larger teeth than those in other series; scales small, sometimes cruciform; caudal fin moderate, more or less bent upward, and usually notched at tip. Oviparous, the egg cases very large, subconical, without tentacles and spirally twisted. Species about 4, all inhabiting the Pacific Ocean, usually placed in one genus; 2 here recognized. Size small. (CESTRACIONTIDÆ, Günther, Cat., VIII, 417–418; but HETERODONTUS, Blainville, 1816, has priority over CESTRACION, Cuvier, 1817.)

## 13. GYROPLEURODUS, Gill.

*Gyropleurodus*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 489, (*francisci.*)
*Tropidodus*, GILL, *l. c.*, (*pantherinus* = *quoyi*).

Branches of the lower jaw widely separated, the interval rounded in front, growing wider behind. Molars in few rows; ridges above eye prominent. Characters of the genus otherwise included above. Eastern Pacific. (*γῦρος*, whorl; *πλεῦρον*, side, *ὀδούς*, tooth.)

*a.* Gill openings not very high, the length of the first slit being less than that of the branchial region; molars in 4 to 6 rows; ridges above eye very prominent.
  *b.* Molars convex, the larger ones not much if any carinated. FRANCISCI, 20.
  *bb.* Molars carinate along their middle. QUOYI, 21.

### 20. GYROPLEURODUS FRANCISCI, (Girard).

(BULLHEAD SHARK.)

Head short and high, broad, but with subvertical sides; the forehead very declivous from eyes, the snout wide and transverse, but prominent; 2 blunt, diverging ridges continued from each side of the snout, abruptly merging into the more conspicuous superciliary ridges, the interval between which is nearly plane; teeth in front digitated, with 3 or 4 cusps, quincuncially distributed in rows slightly converging toward the middle; in the upper jaw, on the sides, molars oblong and flattened, arranged in about 4 oblique whorls, uniform or increasing backward, except the last, which is smallest; on the sides of the lower jaw, also, are molars, oblong, with flattened crowns, and arranged in transversely oblique whorls, but decreasing backward. Branches of the lower jaw widely separated by an interval rounded in front and becoming wider behind, the sides themselves being curved outward; the acute teeth confined to the front, the molar teeth few and disposed in about 4 whorls, the first 3 of which slightly increase, while the fourth is almost rudimentary. Branchial area almost oblong. Dorsal fins considerably produced backward at their posterior angle; the compressed spine forming about ½ of the base of each fin; anal fin large, reaching the root of caudal; caudal fin about ¼ of the length, a notch at its tip, opposite last vertebra. Color brown, with small black spots scattered over the body and fins. L. 2 feet. Coast of California; abundant south of Point Concepcion. Its spirally twisted egg cases are very remarkable. (Name from San Francisco, but its range probably does not extend so far to the north.)

*Cestracion francisci*, Girard, Proc. Ac. Nat. Sci. Phila., 1854, 196, Monterey.
*Cestracion francisci*, Günther, Cat., viii, 416, 1870.
*Gyropleurodus francisci*, Gill, Proc. Ac. Nat. Sci. Phila., 1862, 492; Jordan & Gilbert, Synopsis, 31, 1883.

### 21. GYROPLEURODUS QUOYI, (Fréminville).

First dorsal inserted nearer ventrals than pectorals; anal fin low, not reaching base of caudal; body slender. Brown, with round dark spots about as large as eye. (*Valenciennes.*) Galapagos Islands. (To M. Quoy, a French naturalist.)

*Cestracion quoyi*, Fréminville, Mag. Zoöl., 1840, pl. 3, Galapagos.
*Cestracion pantherinus*, Valenciennes, Voyage de la Vénus, about 1850, 320, Galapagos.
*Cestracion quoyi*, Günther, Cat., viii, 416, 1870.

## Suborder GALEI.

## (The True Sharks.)

Asterospondylous sharks with the palatoquadrate apparatus not articulated with the skull; gill openings always 5 and always lateral. Dorsal fins 2, well developed, each without spines. This order contains most of the living sharks. (γαλεός, a shark.)

*a.* First dorsal fin over or behind the ventrals; spiracle present; no nictitating membrane.
  *b.* Tail not bent upward; nostrils not confluent with the mouth. Scylliorhinidæ, viii.
  *bb.* Tail abruptly directed upward and backward from the base of the caudal fin; nostrils confluent with the mouth. Ginglymostomidæ, ix.
*aa.* First dorsal fin inserted more or less in advance of the ventrals.
  *c.* First dorsal fin long and low, highest posteriorly; spiracles developed; no pit at root of caudal; gill openings all in advance of pectoral. Pseudotriakidæ, x.
  *cc.* First dorsal fin high, highest anteriorly, its base wholly in front of that of ventrals.
    *d.* Caudal fin not lunate, its upper lobe two or more times the length of the lower, with a notch below toward its tip; side of tail not keeled.
      *e.* Last gill opening above base of pectoral.
        *f.* Tail moderately developed, forming less than ⅓ of the total length; eyes with nictitating membranes.
          *g.* Head normally formed. Galeidæ, xi.
          *gg.* Head hammer-shaped or kidney-shaped by the extension of its sides. Sphyrnidæ, xii.
        *ff.* Tail exceedingly long, forming about ½ the total length: eyes without nictitating membrane. Alopiidæ, xiii.
      *ee.* Last gill opening entirely in front of pectoral; spiracles pore-like; tail moderately developed. Carchariidæ, xiv.
    *dd.* Caudal fin lunate; caudal peduncle with a keel on each side; size large.
      *h.* Last gill opening entirely in front of pectorals.
        *i.* Gill openings moderate; teeth large and sharp. Lamnidæ, xv.
        *ii.* Gill openings very large, nearly meeting under the throat; teeth very small; size enormous. Cetorhinidæ, xvi.
      *hh.* Last gill opening above the base of the pectorals. Rhinodontidæ, xvii.

## Family VIII. SCYLLIORHINIDÆ.

### (The Cat Sharks.)

Dorsal fins 2; both rather small, without spines, the first more or less behind the ventrals; anal fin present, usually before the second dorsal; caudal fin rather long, usually with a basal lobe; the tail not keeled, and not bent upward. Spiracles present; no nictitating membrane; gill openings small, the last one above the root of the pectorals. Mouth usually broad, with small teeth, several series being in function; teeth each with a median cusp and 1 to 4 small cusps on each side; nostrils near the mouth, sometimes confluent with it, sometimes provided with cirri. Mucous pores about head numerous, especially on lower side of snout. Egg cases large, quadrate, with prehensile tubes at the angles. (Scylliidæ, Günther, Cat., viii, 400–413.)

*a.* Scylliorhininæ. Spiracles close behind eye; gill openings nearly equidistant; teeth small, usually tricuspid.
  *b.* Nostrils not separated by an isthmus, the nasal valves confluent; tail not serrated. Scylliorhinus, 14.
  *bb.* Nostrils separated from each other by a broad isthmus.
    *c.* Scales on upper margin of the tail little if at all enlarged, usually similar to those on rest of body, or at any rate not forming a serrated edge. Catulus, 15.

### 14. SCYLLIORHINUS, Blainville.

### (Roussettes.)

*Scylliorhinus*, Blainville, Journ. Phys. 1816, 263: (*canicula*, etc.).
*Scyllium*, Cuvier, Règne Animal, Ed. 1, 1817, 124, (*canicula*).
*Scylliorhinus*, Gill, Ann. Lyc. Nat. Hist. N. Y., 1861, 41, reprint, (restriction to *canicula*).

This genus includes those Scyllioid sharks in which the nasal valves are confluent, with their hinder border entire and free. Caudal moderate; gill openings equidistant; spiracles close behind eyes; tail not serrated. Species mostly of the old world. (*σκυλλίον*, a small shark; *σκύλλω*, to tear; *ῥίνη*, shark.)

#### 22. SCYLLIORHINUS PROFUNDORUM, Goode & Bean.

Nasal valves confluent, with a short blunt cirrus on the posterior as well as on the anterior flap; length of nasal cavity about equal to horizontal diameter of the eye, the 2 cavities separated by a space equal to ½ interorbital area and ⅖ snout; distance of posterior angle of nasal cavity from root of teeth at nearest point ½ area between cavities; distance from symphysis to tip of snout equal to width between angles of mouth. A well-developed labial fold at angle of mouth, extending on lower jaw halfway from its angle to the symphysis, and on upper jaw nearly in direction of nasal cavity, disappearing at ½ the distance. Teeth moderate, with 2 small lateral cusps on each side of the longer middle cusp, in about 5 rows. Gill openings narrow, somewhat less than long diameter of eye; distance from first to last, which, like the fourth, is above angle of pectoral, equal to ½ snout. Ventral fins thick, short, leaf-shaped, their origin twice as far from nasal cavity as is last of gill openings; origin of anal under tip of first dorsal, its end under end of dorsal; its base equal to ½ length of head to first gill opening. Caudal continued in line of axis of body; lower lobe rounded, and in its greatest height not deeper than the height of the caudal extension of the body at the same point. Color, uniform grayish brown. One specimen (85646, U. S. N. M.), 20½ inches, obtained by the Fish Commission steamer *Albatross* at a depth of 816 fathoms, in latitude 39° 9′ N., longitude 72° 3′ 15″ W. (*Goode & Bean*). (*profundorum*, of the depths.)

*Scylliorhinus profundorum*, GOODE & BEAN, Oceanic Ichthyology, 17, 1894, Gulf Stream.

## 15. CATULUS, Smith.

*Catulus*, ANDREW SMITH, Proc. Zool. Soc. Lond., 1837, 85, (*stellaris*).
*Poroderma*, SMITH, *l. c.*, (*africanus*).
*Halælurus*, GILL, Ann. Lyc. Nat. Hist. N. Y., 1861, 407, (*bürgeri*).
*Cephaloscyllium*, GILL, *l. c.*, (*laticeps*).

As here understood, this genus is very close to the European genus *Scylliorhinus*,* from which it is distinguished by the separate nasal valves. Gill has further divided the group into *Catulus*, having the nasal valves provided with lobes or grooves, *Halælurus* having the nasal valves simple, and *Cephaloscyllium*, which has a very broad head and the stomach inflatable. The latter group is perhaps generically distinct, but we lack the data for properly defining it. *Catulus* differs from *Pristiurus* in having the scales on the upper edge of the tail not much, if at all, enlarged and usually not differentiated from the others. The prickles on the body are usually much coarser in *Catulus* than in *Scylliorhinus* or *Pristiurus*. Species numerous, usually in rather deep water. (*Catulus*, diminutive of low Latin *catus*, cat.)

I. CATULUS: Head not very broad; belly not capable of great inflation.
- *a.* Body plain brown, or marbled with whitish without black spots or markings; belly dusky.
  - *b.* Upper margin of tail with a broad band of enlarged closely appressed tricuspid scales (obsolete in the young).
    - *c.* Snout from mouth forward ½ width of mouth; anal much longer than second dorsal; belly pale. XANIURUS, 23.
  - *bb.* Upper margin of tail without enlarged scales; belly not pale.
    - *d.* Snout, from mouth, ⅞ width of mouth; anal 2½ times base of second dorsal. BRUNNEUS, 24.
    - *dd.* Snout, from mouth, scarcely ½ width of mouth; anal scarcely larger than second dorsal. CEPHALUS, 25.
- *aa.* Body not plain brown; spotted, or banded, or marbled with black; no enlarged scales on back.
  - *e.* Back of tail covered with narrow black lines which form a net work of polygonal meshes; belly yellowish; body moderately elongate, the stomach probably not inflatable. RETIFER, 26.

II. CEPHALOSCYLLIUM, (κεφαλή, head; Scyllium, σκυλλίον). Head very broad and depressed Stomach capable of great inflation.
- *f.* Back with broad black crossbars; upper part with large round black spots. UTER, 27.

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* *Scylliorhinus*, Blainville, 1816 = *Scyllium*, Cuvier, 1829, type *Sq. canicula*, Linnæus.

### Subgenus CATULUS.

### 23. CATULUS XANIURUS, Gilbert.

Snout short, broadly rounded, its length from mouth, ½ greatest width of snout, which is equal to width of mouth; angle of mouth with folds, that on lower jaw twice as long as on upper, reaching about ¼ distance to symphysis; teeth small; snout and sides of head with numerous mucous pores; eyes large. Pectoral small, rounded; first dorsal over ventrals, its base 2 in the interspace between dorsals, shorter than that of anal; second dorsal slightly shorter and lower than first, its base 1⅗ in anal; caudal 4⅓ in length; upper edge of caudal in adult with a broad band of enlarged, broad, crowded, tricuspid scales, the band broader than in the European *Pristiurus melastomus*, and the scales less acute; scales of body much coarser than in *Pristiurus*. Color dark slaty brown, usually uniform above, sometimes with small whitish spots, the fins often edged with paler; belly pale. L. 2 feet. Pacific coast of Southern California, abundant in rather deep water; apparently a transitional form between *Catulus* and *Pristiurus* with the appearance of the former, but approaching the latter in the scaling of the tail. (*ξανίον*, scraper; *οὐρά*, tail.)

*Catulus xaniurus*, GILBERT, Proc. U. S. Nat. Mus., 1891, 540; off Southern and Lower California, in 184 to 684 fathoms.

### 24. CATULUS BRUNNEUS, Gilbert.

Body deeper, head narrower, snout longer and sharper than in *C. xaniurus*. Preoral part of snout ¾ greatest width of snout and ⅞ width of mouth. Angle of mouth with labial folds, the lower slightly shorter than upper and reaching halfway to symphysis. Eye 3 in snout. Pectorals more adnate to body than usual. First dorsal narrow and high, reaching little beyond ventrals, its base 1½ in interspace between dorsals; second dorsal slightly larger than first; anal very long, its base 2½ times that of either dorsal. Caudal 3⅔ in body, the scales along its upper edge like those on rest of body, not saw-like. Uniform warm brown above and below, the snout and edges of fins blackish. L. 20 inches. Gulf of California, in deep water; one specimen known, a female with mature eggs. (*brunneus*, brown.)

*Catulus brunneus*, GILBERT, Proc. U. S. Nat. Mus., 1891, 542, Gulf of California.

### 25. CATULUS CEPHALUS, Gilbert.

Allied to *C. xaniurus*, but the head wider, the snout shorter, the preoral portion less than ½ its greatest width; color darker, the belly dark brown like the back, the second dorsal larger, more posteriorly placed, the first dorsal larger, the anal smaller, scarcely larger than the second dorsal; pores on head large, in rows instead of patches. Tail without band of enlarged scales (these possibly developed in the adult). Teeth mostly tricuspid, the inner sometimes with 4 or even 5 cusps. Size very small, probably not over 15 inches when adult. Gulf of California and southward, in deep water; no full-grown examples known. (*κεφαλή*, head.)

*Catulus cephalus*, GILBERT, Proc. U. S. Nat. Mus., 1891, 541, deep water near the Revillagigedo Islands and in the Gulf of California, in 362 to 460 fathoms.

### 26. CATULUS RETIFER, (Garman).

Body moderately elongate, the vent in front of its middle. Head depressed, its width nearly equal to its length, from spiracles forward; length of snout from mouth less than distance between outer margins of nostrils; nasal valves broader than isthmus; length of arch of mouth a little more than ½ its width; lower labial fold reaching ¼ distance to symphysis; teeth small, each with a central cusp and 2 small ones on each side. Pectorals short and broad. First dorsal inserted near middle of body; caudal not large. Light brownish, crossed at irregular intervals by groups of 2 to 4 narrow black lines, which are joined by other lines, forming a network of polygonal meshes; belly yellowish. (*Garman.*) Gulf Stream in deep water, a few specimens taken off the South Atlantic coast. (*rete*, net; *fero*, to bear.)

*Scyllium retiferum*, GARMAN, Bull. Mus. Comp. Zoöl., XI, 233, 1881, off coast of Virginia, in deep water.
*Scylliorhinus retifer*, JORDAN & GILBERT, Synopsis, 869, 1883.

### Subgenus CEPHALOSCYLLIUM, Gill.

### 27. CATULUS UTER, Jordan & Gilbert, nom. new species.

### (SWELL SHARK.)

Head very broad and depressed, broader than long, and not ½ as deep as broad. Snout very blunt, projecting a little beyond the mouth. Mouth very broad, little arched, with only a trace of labial fold. Teeth similar in both jaws, small, tricuspid, in about 4 series, $\frac{60}{64}$ in number. First dorsal beginning over middle of ventrals; second dorsal beginning behind front of anal and ending before end of anal. Grayish, tinged below with yellowish; back with black crossbars; upper parts with large round black spots; sides with small whitish spots also. L. 2½ feet. Monterey to San Diego; very abundant in Santa Barbara channel. A small voracious shark, often taken in lobster pots. When caught it inflates its stomach with air till its diameter is ⅓ its whole length. It will then float belly upward on the water. (*uter*, an inflated bladder.)

? *Scyllium ventriosum*, GARMAN, Bull. Mus. Comp. Zoöl., VI, 167, 1880, Chile.
*Scyllium ventriosum*, JORDAN & GILBERT, Synopsis, 59, 1883. It is probable that the Californian species is distinct from the Chilean *ventriosus*. Both are close to the Australian *C. laticeps*, type of the genus or subgenus *Cephaloscyllium*, which differs from *Catulus* in the inflatable belly and the broad depressed head.

## Family IX. GINGLYMOSTOMIDÆ.

### (THE NURSE SHARKS.)

Large sharks with general characters of the SCYLLIORHINIDÆ, but with the tail very long and more or less abruptly bent upward at its base, as in the GALEIDÆ. First dorsal above or behind the ventrals, the second opposite or rather before anal; eyes very small, with small spiracles behind them; nostrils confluent with the mouth. Nasal valves on both sides forming a quadrangular flap in front of the mouth, each being provided with a free cylindrical cirrus; an upper and lower lip, the latter not extending across the symphysis; fourth and fifth gill openings close together. Genera 3, species about 5; large sharks of the warm seas. (SCYLLIIDÆ, part, Günther, Cat., VIII, 407–409.)

*a.* Tail moderate, about ⅓ total length; spiracles minute; snout rather blunt. Teeth in both jaws in many series, each with a strong median cusp, and 1 or 2 smaller cusps on each side; second dorsal nearly opposite anal. GINGLYMOSTOMA, 16.

## 16. GINGLYMOSTOMA, Müller & Henle.

*Ginglymostoma*, MÜLLER & HENLE, Wiegmann's Archiv., 22, 1837, (*cirratus*).

Characters of this genus given above. (*γίγγλυμος*, hinge; *στόμα*, mouth.)

### 28. GINGLYMOSTOMA CIRRATUM, (Gmelin).

(NURSE SHARK; GATA.)

Head obtuse, depressed; nasal cirrus reaching the lower lip; angles of the fins obtusely rounded; tail forming nearly ¼ of the total length; skin very thick. Uniform brownish; young specimens with small, scattered, round black spots. L. 6 to 10 feet. A large shark of the warmer parts of the Western Hemisphere, abundant about coral reefs in the West Indies and on the west coast of Mexico, and occasionally on our South Atlantic coast. (*cirratus*, bearing cirri.)

*Squalus cirratus*, GMELIN, Syst. Nat., I, 1492, 1788; American Seas, after Broussonet.
*Ginglymostoma cirratum*, MÜLLER & HENLE, Plagiostomen, 23, 1838; GÜNTHER, Cat., VIII, 408, 1870.
*Squalus cirratus*, BONNATERRE, Tableau Encycloped. Ichthyol., 7, 1788; after Barbillon of Broussonet.
*Squalus punctatus*, BLOCH & SCHNEIDER, Syst. Ich., 134, 1801; Cuba, after Gata Hispanis of Parra.
*Squalus punctulatus*, BLOCH & SCHNEIDER, *l. c.*, 549; Cayenne, after *Squale pointillé* of Lacépède.
*Squalus argus*, BANCROFT, Zoöl. Jour., v, 82, 1832-1834, West Indies.
*Ginglymostoma fulvum*, POEY, Memorias, II, 342, 1861, Havana. This name was applied to unspotted specimens; these occur on both coasts of Mexico, and the absence of spots in the young is probably an individual variation. If not, *G. fulvum* may rank as a species or subspecies.
*Ginglymostoma caboverdianus*, CAPELLO, Jour. Sci. Phys. Lisb., 1867, 167, Cape Verde.

## Family X. PSEUDOTRIAKIDÆ.

Body elongate; mouth wide, with a very short labial fold near the angle; snout depressed; nostrils inferior, not confluent with the mouth; eyes oblong, lateral, without nictitating membrane; spiracles well developed, behind the eye; gill openings moderate, in advance of pectoral; jaws with many rows of very small, tricuspid teeth; first dorsal fin long and low, highest posteriorly, inserted opposite the space between the pectorals and ventrals; second dorsal rather large, larger than anal; ventrals and pectorals well developed; no pit at root of caudal; caudal fin very low and long. Skin with minute asperities. One species known, a large shark of the North Atlantic, in most respects similar to the SCYLLIORHINIDÆ, but having the dorsal fin different in form and placed farther forward. The insertion of the first gill opening is also different. For these reasons we have placed the genus provisionally in a distinct family. (PSEUDOTRIACIS, Günther, Cat., VIII, 395.)

## 17. PSEUDOTRIAKIS, Capello.

*Pseudotriakis*, Capello, Jour. Sci., Math., Phys., Nat., Lisbon, 1868, 321, (*microdon*).

Characters of the genus given above. (ψευδής, false; *Triakis*.)

### 29. PSEUDOTRIAKIS MICRODON, Capello.

Grayish brown, the fins, except the first dorsal, edged with dusky; base of first dorsal 7 times its height. Two specimens of this species are known—the type from Portugal; the second, 10 feet in length, taken at Amagansett, on Long Island. (μικρός, small; ὀδούς, tooth.) (Eu.)

*Pseudotriakis microdon*, Capello, Jour. Sci., Math., etc., Lisbon, 1868, 321, Portugal; Günther, Cat., viii, 395, 1870; Bean, Proc. U. S. Nat. Mus., 1883, 147.

## Family XI. GALEIDÆ.

### (The Requiem Sharks.)

Sharks with 2 dorsal fins, the first short and high, entirely before the ventrals, the second comparatively small, opposite the anal; no spines; gill openings moderate, the last above the base of the pectorals; tail more or less bent upward from the base of the caudal fin; sides of tail not keeled; eyes with nictitating membranes; head not hammer-shaped, the snout being longitudinally produced, as usual among sharks. Ovoviviparous. Spiracles small or obsolete.

A large family of 20 or more genera and about 60 species; found in all seas. The species are often closely related and difficult of determination. (Carchariidæ, part (Carchariina and Mustelina), Günther, Cat., viii, 357–380, and 383–388.)

*a.* Galeinæ: Teeth flat and paved, without cusps or ridges; spiracles present; no pit at root of tail; labial folds well developed.

*b.* Embryo not attached to the uterus by a placenta; teeth very blunt. Mustelus, 18.

*bb.* Embryo attached to the uterus by a placenta; teeth more acute. Galeus, 19.

*aa.* Teeth more or less compressed, with entire or serrate sharp edges.

Galeorhininæ:

*c.* Spiracles present.

*d.* Root of tail without pit.

*e.* Teeth rather small, each with a medium cusp and 1 or 2 small lateral cusps on each side.

*f.* Teeth small, close-set, approaching those of *Galeus* but with pointed cusps; snout slender; embryo attached to uterus by a placenta. (Coloration plain.) Rhinotriacis, 20.

*ff.* Teeth larger, with sharp cusps; snout of moderate length; embryo not attached to uterus by a placenta. (Coloration variegated.) Triakis, 21.

*ee.* Teeth larger, with a single cusp, oblique, notched and coarsely serrated on the outer margin. Galeorhinus, 22.

*dd.* Root of tail without conspicuous pit above; teeth all coarsely serrate, alike in both jaws and all with a deep notch on outer margin; caudal fin with a double notch. Galeocerdo, 23.

CARCHARHININÆ:

cc. Spiracles obsolete; lower teeth narrower than upper teeth.

*g.* Angle of mouth without groove or with merely a slight depression, which does not extend along either jaw.

*h.* First dorsal fin inserted posteriorly, nearer ventrals than pectorals; embryo not joined to the uterus by a placenta; slender sharks, with very strongly serrated teeth. PRIONACE, 24.

*hh.* First dorsal inserted anteriorly, nearer pectorals than ventrals; embryo (so far as known) attached to the uterus by a placenta.

*i.* Teeth all serrate more or less, often entire in the very young. CARCHARHINUS, 25.

*ii.* Teeth of upper jaw serrate at base only; lower teeth entire, erect. HYPOPRION, 26.

*iii.* Teeth all entire at all ages, and nearly all erect. APRIONODON, 27.

*gg.* Angle of mouth provided with a more or less distinct groove which extends along one or both of the jaws; teeth entire, or very nearly so, more or less obliquely placed, their points turned away from the median line; embryo (so far as known) with a placenta. SCOLIODON, 28.

## 18. MUSTELUS, Cuvier.

### (DOG SHARKS.)

*Mustelus*, CUVIER, Règne Animal, Ed. 1, 128, 1817, (*mustelus* and *canis*).

*Mustelus*, GILL, Proc. Ac. Nat. Sci. Phila., 1864, 148, (restricted to *canis* and its relatives, the allies of *Mustelus* being called *Pleuracromylon*).

Body elongate, slender; snout comparatively long and flattened; mouth crescent-shaped, with well-developed labial folds; teeth small, many-rowed, flat and smooth, rhombic, arranged like pavement, alike in both jaws, and blunter than in any other sharks; eyes large, oblong; spiracles small, just behind the eyes; pectoral fins large; first dorsal large, not much behind pectorals; second dorsal somewhat smaller; anal opposite second dorsal and still smaller; ventrals well developed; basal lobe of caudal almost obsolete, the tail nearly straight; embryo not attached to the uterus by a placenta. Small sharks, among the smallest of the American species. (*mustelus*, a weasel or marten; the same word used for shark, as is the synonymous word *galeus*.)

*a.* Middle of first dorsal evidently nearer posterior root of pectoral than anterior root of ventral; snout long, its length from mouth more than width of mouth; teeth blunt. Embryo not examined, probably as in *M. canis*. LUNULATUS, 30.

*aa.* Middle of first dorsal about midway between pectorals and ventrals (as above measured). First dorsal higher than long, the tip of anterior lobe reaching, when depressed, beyond tip of posterior lobe, its free margin deeply incised, its base 2¾ times in interval between dorsals; teeth blunt. CANIS, 31.

### 30. MUSTELUS LUNULATUS, Jordan & Gilbert.

(GATO.)

Free margin of fins concave; first dorsal high, its narrow anterior lobe reaching tip of the slender posterior lobe when deflected, the fin about as high as long; interval between dorsals 2⅗ times base of first; lower lobe of caudal pointed; tail 5 in body, its terminal lobe more than ⅛ its length; pectoral rather sharp, its free margin incised, its tip about reaching middle of dorsal. Embryo unknown (probably without placenta). Very pale gray, fins all pale. L. 20 inches. West coast of Mexico, common in Gulf of California. (*lunulatus*, somewhat moon-shaped, from the concave margins of the fins).

*Mustelus lunulatus*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 108, Mazatlan, Mexico. (Type, No. 29211.)

### 31. MUSTELUS CANIS, (Mitchill).

(Smooth Hound; Dog-shark; Boca Dulce.)

Body slender, tapering backward from the dorsal fin to the long slender tail; snout depressed, moderately sharp: mouth small, the teeth all alike bluntish; a fold at the angle of the mouth; lower lobe of caudal blunt; tail more than ⅕ body, its terminal lobe more than ⅓ its length; pectorals rather obtuse, their free margins little incised, their tips reaching first third of dorsal; inner lobe of ventrals produced; embryo without placenta. Coloration light gray, nearly uniform, sometimes with pale spots. Length 2 to 3 feet. Cape Cod to Cuba and in Southern Europe; abundant on the Atlantic coasts of both continents, especially off New York and in the Mediterranean. (*canis*, dog.) (Eu.)

*Squalus canis*, Mitchill, Trans. Lit. Phil. Soc. N. Y., 1, 1815, 486, New York.

*Mustelus asterias*, Cloquet, Dict., 407, 1820, Europe.

*Mustelus vulgaris*, Müller & Henle, Plagiostomen, 190, pl. 27, fig. 1, 1838, Europe.

*Squalus hinnulus*, Blainville, Faune Franc., 83, pl. 20, fig. 2, 1828, Mediterranean.

*Mustellus stellatus*, Risso, Eur. Merid., iii, 1826, 126, Nice.

*Mustelus plebejus*, Bonaparte, Fauna Italica, part viii, 43, plate 132, 1834, Italy.

*Mustelus vulgaris*, Günther, Cat., viii, 386, 1870.

*Mustelus canis*, Storer, Fish. Mass., 227, 1867; Jordan & Gilbert, Synopsis, 870, 1883.

## 19. GALEUS, Rafinesque.

*Galeus*, Rafinesque, Caratteri Alcuni Nuovi Generi, 13, 1810, (*mustelus*,* etc.; the intended type is apparently *Sq. galeus*, L., though that species is not mentioned by name).

*Galeus*,† Leach, Observ. genus *Squalus*, 62, 1812, (*mustelus*).

*Pleuracromylon*, Gill, Proc. Ac. Nat. Sci. Phila., 1864, 148, (*lævis*=*mustelus*).

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* *Galeus mustelus* (Linnaeus), the Smooth Hound, of Europe, has been listed as American by Dr. Günther, who records a stuffed specimen from New York. No American collector has recognized it.

† The name *Galeus* was first used in binominal nomenclature by Rafinesque, for a genus thus defined:

"VIII. G. Galeus. Due spiragli, due ale dorsali, un ala anale, cinque branchie da ogni lato, coda diseguale, obliqua.

"*Osservazione.* La maggior parti delli *Squali* degli autori si annoverano in questo genere, il quale si distingue dal vero genere *Squalus* della presenza di un ala anale."

Four species are mentioned, *vulpeculus*, *melastomus*, *catulus*, and *mustelus*. The species which the author had in mind was doubtless *Squalus galeus*, L.

This well-known species agrees with the above diagnosis, and although not explicitly included in the genus (for Rafinesque's paper treated only of new species and new genera), yet it would go with the others as one of the "maggior parti delli *Squali*." An important argument for this view rests in the fact that Rafinesque adopted many Linnæan specific names for his genera, and in most cases explicitly specified such Linnæan species as the types of his genera. There can be no doubt that *Squalus galeus*, L., was his type of his genus *Galeus*, and *Squalus carcharias*, L., his type of his *Carcharias*.

In 1812, Leach proposed a genus *Galeus*, to include sharks with the anal fin present and the caudal fin irregular (*i. e.*, not lunate). This genus thus defined, corresponds nearly to *Galeus* of Rafinesque. But one species, *Galeus mustelus*, is mentioned by Leach, the same species having been included in *Galeus*, Rafinesque. For this reason we have formerly adopted the name *Galeus* for *G. mustelus*. Still later, a subgenus, *Galeorhinus*, was proposed by Blainville for sharks distinguished from *Carcharinus*, Blainville, by the presence of spiracles. This group again corresponds to the *Galeus* of Rafinesque and Leach. In this group are included with others, *Squalus mustelus* and *Squalus galeus* of Linnæus, the latter species being obviously intended as the type. Still later (1817), the genera *Mustelus* and *Galeus* were defined by Cuvier, and with his definition

This genus is very close to *Mustelus*, with which it agrees in most external respects, the essential difference being in the presence of a placenta connecting the embryo with the uterus. The teeth are rather sharper than in *Mustelus*. The boundaries of this group and the preceding are not yet well defined, and it may be that the two should be reunited. (*γαλεός*, a kind of shark, like *γαλῆ*, the weasel.)

*a.* Middle of first dorsal about midway between posterior root of pectorals and anterior root of ventrals; first dorsal longer than high; its tip not reaching tip of posterior lobe, its free margin scarcely incised, its base about half the interval between dorsals; teeth sharpish. (Embryo not examined.) DORSALIS, 32.

*aa.* Middle of first dorsal much nearer root of ventrals than pectorals; snout rather short, its length from mouth a little less than distance between angles of mouth; teeth rather sharp. CALIFORNICUS, 33.

### 32. GALEUS DORSALIS, (Gill).

Lower lobe of caudal not acute; tail less than ⅕ total length, its terminal lobe less than ⅓ its length; pectorals obtuse, their free edges almost straight, their tips reaching first fourth of dorsal; inner lobe of ventrals not produced, the free edge of the fin straight. Embryo with placenta. Color dark gray, axils of pectorals and ventrals dusky. L. 3 to 4 feet. Panama and neighboring waters, north to the Gulf of California, the largest species of the group. (*dorsalis*, pertaining to the back.)

*Mustelus dorsalis*, GILL, Proc. Ac. Nat. Sci. Phila., 1864, 149, Panama.
*Mustelus dorsalis*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 110.

### 33. GALEUS CALIFORNICUS, (Gill).

First dorsal longer than high, its blunt tip when depressed not reaching tip of posterior lobe, its margin deeply incised, its base 2¼ times in the interval between dorsals; lower lobe of caudal blunt; terminal lobe of tail more than ⅓ its length, pectorals rather obtuse, their free margin little concave, their tips reaching little past front of dorsal; inner lobe of ventrals somewhat produced; embryo attached to uterus by a placenta. Dark grayish; axils of pectorals and ventrals dusky. L. 30 inches. California, north to San Francisco; rather common.

*Mustelus californicus*, GILL, Proc. Ac. Nat. Sci. Phila., 1864, 148, San Francisco.
*Mustelus californicus*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 110.
*Mustelus californicus*, JORDAN & GILBERT, Synopsis, 870, 1883.

## 20. RHINOTRIACIS, Gill.

*Rhinotriacis*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 486, (*henlei*).

General appearance of *Galeus*, but with the teeth distinctly tricuspid and not paved. Snout sharp. Embryo attached to the uterus by a placenta. Coloration plain. One species known. (*ῥίν*, snout; *Triacis*).

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they have been accepted by nearly all later authors. It seems to us best in cases like this to follow the rules of nomenclature strictly. The strict letter of the law seems to require the use of *Galeus* in place of *Pleuracromylon*.

The name *Mustelus* was at first applied by Cuvier to the whole group of smooth-mouthed sharks. It has, however, been restricted by Gill to the subgenus typified by *M. canis*, and it should be retained for this subdivision, leaving *Pleuracromylon*, or *Galeus*, as the name of the other genus or subgenus.

### 34. RHINOTRIACIS HENLEI, Gill.

Snout produced, slender. L. 2½ feet. Color uniform reddish brown above, pale below, the pectoral, ventral, and anal fins margined with paler. Coast of California from Humboldt Bay to Monterey, a rather rare and imperfectly known species. (Named for Prof. J. Henle, the associate of Johannes Müller.)

*Rhinotriacis henlei*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 486, San Francisco.
*Triacis henlei*, JORDAN & GILBERT, Synopsis, 20, 1883.

## 21. TRIAKIS, Müller & Henle.

*Triakis*, MÜLLER & HENLE, Magazine of Natural History, II, new series, 36, 1838, (*scyllium*). (*Triacis*, corrected spelling.)

Body compressed, elongate; mouth large, crescent-shaped, with well-developed long labial folds; teeth moderate, numerous, similar in both jaws, each with a longer median cusp, and 1 or 2 smaller ones on each side; eyes small, with nictitating membrane; spiracles small, behind the eyes; no pit at the root of the caudal; no lower lobe to the caudal; first dorsal fin opposite the space between the pectorals and ventrals. Embryo without placenta. Coloration variegated, black and gray. Pacific and Indian Oceans. (*τρεῖς*, three; *ἀκίς*, point.)

### 35. TRIAKIS SEMIFASCIATUM, Girard.

(CAT SHARK; LEOPARD SHARK.)

Snout moderately produced, rounded. Nostril with a broad anterior flap. First dorsal fin nearly midway between the pectorals and ventrals; the second dorsal not much smaller than the first, and partly in advance of the anal. Gray, the upper parts with well-defined black cross bands, narrower than the interspaces; a row of rounded black spots along the sides of the body, alternating with the interdorsal crossbars. L. 3 feet. Cape Mendocino to San Diego, common; a handsome shark, readily known by its variegated coloration. (*semifasciatus*, half banded.)

*Triakis semifasciatum*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 196, Presidio de San Francisco; JORDAN & GILBERT, Synopsis, 20, 1883; GÜNTHER, Cat., VIII, 384, 1870.
*Mustelus felis*, AYRES, Proc. Cal. Ac. Sci., 1854, 17, San Francisco.

## 22. GALEORHINUS, Blainville.

(TOPES.)

*Galeus*,* RAFINESQUE, Caratteri Alcuni Nuovi Generi, 13, 1810, in part, (*galeus*, etc., although that species is not explicitly mentioned).
*Galeorhinus*, BLAINVILLE, Bull. Sci. Philom., 1816, 121, (*galeus*).
*Galeus*, CUVIER, Règne Animal, Ed. I, 127, 1817, (*galeus*).
*Eugaleus*, GILL, Proc. Ac. Nat. Sci. Phila., 1864, 148, (*galeus*).

First dorsal opposite the space between the pectorals and ventrals; mouth crescent-shaped, with the teeth alike in both jaws, oblique, notched, and serrated; spiracles present, small; nictitating membrane present; no pit at the base of the caudal; caudal fin with a single notch. Tropical seas. (*γαλεός*, a kind of shark, like a weasel, *ῥίνη*, shark.)

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* See note under *Galeus*.

### 36. GALEORHINUS ZYOPTERUS, Jordan & Gilbert.

(Oil Shark; Soup-fin Shark.)

Snout depressed, rather long, rounded at tip; nostrils nearer mouth than tip of snout; teeth about $\frac{32}{30}$, the 4 or 5 nearest the middle much smaller, the median tooth of each jaw smallest, subtriangular, without basal cusps; lateral teeth of both jaws similar, their points directed strongly outward; a sharp angle near middle of outer margin, below which are 2 to 5 sharp cusps or serrations; eye large; second dorsal scarcely $\frac{1}{4}$ size of first. Dusky grayish, most of pectoral, tip of caudal, and anterior portion of both dorsals black. L. 6 feet. Coast of Southern California from San Fráncisco to Cerros Island; very abundant. Valued for the oil in its liver, and for the fins, which are much prized by the Chinese; the gelatinous fin rays making a fine soup. Closely related to the European Tope (*G. galeus*, (L.)), from which it may prove to be indistinguishable. (*ζυόν*, soup; *πτερόν*, fin.)

*Galeorhinus zyopterus*, Jordan & Gilbert, Synopsis, 871, 1883, San Pedro, California. (Type, No. 26973.)

## 23. GALEOCERDO, Müller & Henle.

*Galeocerdo*, Müller & Henle, Plagiostomen, 59, 1838, (*tigrinus*).
*Boreogaleus*, Gill, Ann. Lyc. Nat. Hist. N. Y., vii, 411, 1861, (*arcticus*).

Mouth crescent-shaped; teeth alike in both jaws, large, oblique, coarsely serrated on both margins, with a deep notch on outer margin; spiracles present; caudal fin with a double notch; a pit on the tail above and below at the base of the caudal fin; first dorsal opposite the space between pectorals and ventrals. Large sharks, found in most seas. (*γαλεός*, a kind of shark, like *γαλῆ*, the weasel; *κερδώ*, a fox or weasel.)

### 37. GALEOCERDO TIGRINUS, Müller & Henle.

(Tiger Shark; Alecrin; Tigrone.)

Caudal fin forming about $\frac{1}{3}$ of the total length, much longer than the space between the dorsal fins; second dorsal somewhat in advance of the anal; a long labial fold along the upper jaw. Color brown, with numerous dark spots larger than the eye; adult nearly plain. Tropical seas, not rare, occasionally northward to Cape Cod and to San Diego. L. 15 to 30 feet. A very large and fierce shark, known by its variegated coloration, the most formidable of the West Indian species.* (*tigrinus*, tiger-like).

*Galeocerdo tigrinus*, Müller & Henle, Plagiostomen, 59, 1838; Günther, Cat., viii, 378, 1870; Jordan & Gilbert, Synopsis, 21, 1883.
*Galeus maculatus*,† Ranzani, De Novis Speciebus Piscium, Dissert. Prima, 7, 1838, Brazil.
*Galeocerdo maculatus*, Poey, Synopsis, 455, 1868.

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* "Le ha sacado del vientre del madre más de 60 felos prontos á nacer vivos y a poblar el abismo." *Poey.*

† We are unable to decide which of these two names of the same date, *tigrinus* and *maculatus*, is entitled to priority. Common usage has accorded precedence to the work of Müller & Henle.

## 24. PRIONACE, Cantor.

### (Blue Sharks.)

*Prionodon*, Müller & Henle, Plagiostomen, 36, 1838, (*glaucus*, etc., name preoccupied).
*Prionace*, Cantor, Malayan Fishes, 399, 1850, (substitute for *Prionodon*).
*Cynocephalus*, (Klein), Gill, Ann. Lyc. Nat. Hist. N. Y., 1861, 401, (*glaucus*).

Large sharks with the body and head slender; no spiracles; the teeth in both jaws strongly serrated in the adult, those in the upper jaw broad, those below narrower, straight, and claviform; first dorsal large, inserted midway between axils of pectorals and ventrals; second dorsal much smaller, usually not larger than anal; embryo not attached to the uterus by a placenta. Species rather few; large, slender, swift, voracious sharks of the warm seas. The groups here called *Prionace*, *Hypoprion*, *Aprionodon*, and *Scoliodon* are usually placed as subgenera under *Carcharhinus* or *Carcharias*, as the group has been commonly called. Their retention as distinct genera is apparently justified on the ground of convenience. (*πρίων*, saw; *ἀκίς*, point).

### 38. PRIONACE GLAUCA, (Linnæus).

### (Great Blue Shark.)

Snout very long; nostrils rather nearer to the mouth than to the extremity of the snout; no labial fold except a groove at the angle of the mouth; teeth of the upper jaw oblique, scarcely constricted near the base; lower teeth slender, triangular in young examples, lanceolate, with a broad base, in old ones. Pectoral fin long, falciform, extending to the dorsal, which is nearer the ventrals than the root of the pectorals. Color light bluish gray above, paler below. A large shark of the warm seas, occasionally taken on our coasts (a few specimens from San Francisco and Monterey). More common in Europe. (Eu.)

*Squalus glaucus*, Linnæus, Syst. Nat., Ed. x, 235, 1758, Seas of Europe.
*Carcharias glaucus*, Günther, Cat., viii, 364, 1870.
*Carcharhinus glaucus*, Jordan & Gilbert, Synopsis, 22, 1883.
*Squalus cæruleus*, Blainville, Faune Française, 91, 1828, Medeiterranean.
*Squalus hirundinaceus*, Valenciennes, in Müller & Henle, Plagiostomen, 37, 1838, Brazil.

## 25. CARCHARHINUS, Blainville.

*Carcharias*,* Rafinesque, Caratteri Alcuni Nuovi Generi, 10, 1810, (in part; *taurus*, the only species named).
*Carcharhinus*, Blainville, Journ. Phys., 1816, 264; (*commersoni*, a name based on Lacépède's figure of "*Squalus carcharias*"; it apparently represents *Carcharhinus lamia*).
*Carcharias*, Cuvier, Règne Animal, Ed. 1, 125, 1817, (*carcharias*, expressly identified with *Canis carcharias* of Bélon (de Aquatilibus, 1, 60), which is the species commonly called *Carcharias lamia*).
*Eulamia*, Gill, Ann. Lyc. Nat. Hist. N. Y., 1861, 401, (*lamia*).
*Platypodon*, Gill, *l. c.*, 401, (*menisorrah*).
*Isogomphodon*, Gill, *l. c.*, 401, (*oxyrhynchus*).
*Lamiopsis*, Gill, *l. c.*, 401, (*temmincki*).

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* The name Carcharias as a generic term was first used by Rafinesque in 1810. It was thus defined:

"G. Carcharias. Nessuno spiraglio, due ale dorsali, un ala anali, cinque aperture branchiali da ogni lato. Coda disiguale obbliqua. *Oss.*, Questo genere é il primo nell' ordine delli *Squalini*, e contiene le specie le piú enorme e le piú voraci; differisce notabilmente del genere *Galeus* dalla

Body rather robust, the head broad and depressed; mouth inferior, with the teeth in both jaws strongly serrated in the adult, less so or entire in the young; those in the upper jaw broad or narrow, those below narrow, straight, and nearly erect. No spiracles. First dorsal large, placed not far behind pectorals; pectorals falcate; second dorsal small. Embryos attached by placenta to the uterus, as in *Scoliodon*,* *Triakis*, and *Galeus*. Species very numerous and difficult of separation. Voracious sharks of the warm seas. (*καρχαρίας*, an old name of *C. lamia*, from *κάρχαρος*, jagged; *ῥίνη*, shark, the name first applied to *Squatina*, from its rasp-like skin; *ῥίνη*, a file.)

*a.* Teeth in both jaws distinctly serrate in the adult; the serræ on the lower teeth smaller; upper teeth rather broad, lower teeth narrower; snout not very acute.

PLATYPODON, (*πλατύς*, broad; *ὑπο*, under; *ὀδούς*, tooth):

*b.* Upper teeth oblique, deeply notched on the outer margin; lower teeth narrow, scarcely or not notched.

*c.* Pectorals very large, 3 times as long as broad, falciform, extending beyond base of first dorsal; color blue-gray. OBSCURUS, 39.

*cc.* Pectorals shorter, not 3 times as long as broad, extending little if any beyond base of first dorsal.

*d.* Length of snout from mouth, little if any greater than width of mouth.

*e.* Distance from end of base of first dorsal to ventrals less than length of base of first dorsal.

*f.* Nasal flap without sharp lobe.

*g.* Second dorsal smaller than anal; snout depressed; first dorsal close behind pectorals. Light gray. PLATYRHYNCHUS, 40.

*gg.* Second dorsal and anal nearly equal; color blue-gray. FALCIFORMIS, 41.

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mancanza degli Spiragli." Under this group one new species is described, *Carcharias taurus*, a species of *Odontaspis*, as the genera have been understood.

No type is indicated by Rafinesque, but it is evident that he had the *Squalus carcharias* of Linnæus in mind as type, in accordance with his custom of raising Linnæan species to the rank of genera. In Rafinesque's Indice, published in the same year, 1810, a few months later, *Squalus carcharias*, L., appears as the type of *Carcharias* under the name of *Carcharias lamia*. The *Squalus carcharias* of Linnæus as understood by Rafinesque was *Carcharhinus lamia*. It was primarily based on *Carcharodon carcharias*, a species not known to most of the succeeding authors, who applied the name *Squalus carcharias* to *Carcharias lamia* instead of to *Carcharodon*. Cuvier distinctly makes *lamia* the type of his genus *Carcharias* as he refers to Bélon's figure of "*Canis carcharias*" as the only good representation of his species.

Bélon's figure plainly represents *Carcharias lamia*. It is also evident that Rafinesque has the *lamia* in mind in referring to his "*Squalus carcharias*" or "*Carcharias lamia.*" The phrase "Coda disiguale, obbliqua," shows this, as also does the fact that the species was placed in the list of Sicilian fishes. *Carcharias lamia* is common in Sicily. *Carcharodon carcharias* is rare in the Mediterranean. In fact, few of the earlier writers in Italy or France knew the *Carcharodon*, and referred all accounts of it to the great shark known to them, *Carcharias lamia.* So far as intention of the author goes, *Carcharias* of Rafinesque should be strictly synonymous with *Carcharias* of Cuvier, and both based on the same type as the *Eulamia* of Gill. *Carcharhinus* of Blainville was originally based, according to Gill, on his *Squalus commersoni*, which seems to be *Carcharinus lamia.* In this connection we may note that Rafinesque, in 1810, seemed to have used but two general treatises on fishes, the Systema Naturæ of Linnæus, and the Historie Naturelle des Poissons of Lacépède. Rafinesque's genus *Carcharias* is Lacépède's "Premier sousgenre, une nageoiré de l' anus sans évents." His *Galeus* is the "Second sousgenre une nageoiré de l' anus et deux évents," while the name *Squalus* is retained by him for the "Troisième sousgenre, deux évents sans nageoire de l' anus." Rafinesque's remaining genera, *Dalatias*, *Tetroras*, *Isurus*, *Cerictius*, *Alopias*, etc., are based on species supposed by Rafinesque to be new.

If we should refer Rafinesque's genera to the groups of Lacépède, on which they were really based, *Carcharias* would be equivalent to *Carcharhinus* and *Galeus* to *Galeorhinus*. On the other hand, the strict rule of requiring the type of a genus to be taken from the species actually mentioned by its author makes the arrangement here adopted the necessary one. As in other disputed cases, we here follow the rules strictly.

* So far as known to us, the embryos in all our other viviparous sharks are without placentæ.

*ff.* Nasal flap with an acute lobe.

*h.* Snout not very short, its length from mouth not notably less than width of mouth. Color yellowish brown. ACRONOTUS, 42.

*hh.* Snout very short and blunt, its length from mouth but ⅔ width of mouth. PEREZI, 43.

*ee.* Distance from end of base of first dorsal to ventrals greater than length of first dorsal; snout moderate. REMOTUS, 44.

*dd.* Length of snout from mouth greater than width of mouth; first dorsal small. HENLEI, 45.

CARCHARHINUS:

*bb.* Upper teeth triangular, suberect, scarcely notched on the outer margin; lower teeth similar but much narrower.

*i.* Snout moderate, its length from mouth about equal to width of mouth.

*j.* Pectorals not falcate; fins not conspicuously darker at tips. Atlantic. MILBERTI, 46.

*jj.* Pectorals somewhat falcate; second dorsal rather smaller than anal; fins scarcely dusky at tip. Pacific. LAMIELLA, 47.

*ii.* Snout very short, its length from mouth less than width of mouth.

*k.* Pectoral long and falcate, reaching to posterior part of base of dorsal. Atlantic.

*l.* Anterior margin of first dorsal convex, the height of the fin about equal to depth of body. LAMIA, 48.

*kk.* Pectoral fin moderate, scarcely falcate, not reaching to end of base of dorsal.

*m.* Second dorsal not larger than anal; length of snout from mouth 1½ times in breadth of mouth; upper teeth very broad. Atlantic. PLATYODON, 49.

*mm.* Second dorsal larger than anal.

*n.* Length of snout from mouth but ½ breadth of mouth; upper teeth not very broad; head very broad above. Pacific. FRONTO, 50.

*nn.* Length of snout from mouth more than ½ breadth of mouth; fresh waters. NICARAGUENSIS, 51.

ISOGOMPHODON, (ἴσος, equal; γόμφος, nail; ὀδούς, tooth):

*aa.* Teeth slightly serrated, similar in form in the two jaws, narrow, claviform, constricted at base; snout rather sharp.

*o.* Snout moderate, its length from mouth not greater than the breadth of mouth; teeth moderate, about 30 in each jaw; fins edged with black.

*p.* Base of anal a little longer than that of second dorsal; pectoral reaching end of base of first dorsal. ÆTHALORUS, 52.

*pp.* Base of anal equal to that of second dorsal; pectoral reaching past base of first dorsal. LIMBATUS, 53.

*oo.* Snout very long and narrow, its length from mouth twice distance between nostrils; teeth small, about 48 in each jaw. OXYRHYNCHUS, 54.

### Subgenus PLATYPODON, Gill.

### 39. CARCHARHINUS OBSCURUS, (Le Sueur).

(DUSKY SHARK.)

Head rather pointed, flattened above and below; first dorsal rather large; second dorsal smaller than the anal, and considerably produced behind; pectorals very large, falciform, extending beyond the end of the dorsal, their outer margin 4 times the inner. Dark clear blue above, white below. A large shark, reaching a length of 9 or 10 feet, inhabiting the Middle Atlantic and frequently taken on our coast. (*obscurus*, dusky.)

*Squalus obscurus*, LE SUEUR, Jour. Ac. Nat. Sci. Phila., 1818, 1, 223, New York.
*Carcharias obscurus*, GÜNTHER, Cat., VIII. 366, 1870.
*Carcharhinus obscurus*, JORDAN & GILBERT, Synopsis, 22, 1883.
*Carcharias falcipinnis*, LOWE, Proc. Zoöl. Soc. Lond., 1839, 90, Madeira.
*Prionodon obvelatus*, VALENCIENNES, Poiss. Iles Canaries, 103, 1836, Canaries.

### 40. CARCHARHINUS PLATYRHYNCHUS, (Gilbert).

Snout moderate, not pointed, very flat, and broadly rounded ; its length from mouth slightly greater than width of mouth, and less than width of snout opposite nostrils. No labial folds; nostril flap without acute lobe; upper teeth broadly triangular, coarsely serrate, the inner edge oblique, the outer more or less definitely notched ; lower teeth narrow, erect; eye moderate. Pectorals little falcate, long, reaching beyond base of first dorsal, the fin about ½ as broad as long ; first dorsal inserted close behind pectoral, its distance from pectoral ⅖ its base; its base 2½ times in interspace between dorsals, and less than its height, which is less than depth of body; second dorsal inserted over anal, its base 3 in first dorsal, the fin smaller than anal; caudal 3½ in total length. Light gray, the fins colored like the body. Magdalena Bay to Galapagos Islands ; probably not rare. Resembles *C. lamiella*, from which it differs in dentition and in position of first dorsal. (*πλατύς*, flat; *ῥύγχος*, snout.)

*Eulamia platyrhynchus*, GILBERT, Proc. U. S. Nat. Mus., 1891, 544, Clarion Island, Socorro Island, Magdalena Bay.

### 41. CARCHARHINUS FALCIFORMIS, (Bibron).

(CAZON DE PLAYA.)

Snout moderately prolonged and acute; nostrils without lobe; first dorsal rather backward ; second dorsal and anal opposite each other and of medium size; pectorals not twice as long as broad; upper teeth with a marked reëntrant angle on the outer border; 2 pores on the nape, well marked. Color, blue-black, deeper than in any other species. L. 10 feet. (Poey.) Cuba and neighboring waters. (*falx*, scythe; *forma*, form.)

*Carcharias falciformis*, BIBRON, in Müller & Henle's Plagiostomen, 47, 1838, Cuba.
*Squalus tiburo*, POEY, Memorias, II, 331, 1861, Havana.
*Platypodon falciformis*, POEY, Enumeratio, 191, 1875.

### 42. CARCHARHINUS ACRONOTUS, (Poey).

Close to *C. falciformis*, but with an acute lobe to the nostril; first dorsal farther forward; the second dorsal and anal larger; pectoral scarcely falciform; nuchal pores inconspicuous; color yellowish brown. (Poey). Cuba. (*ἀκρός*, sharp; *νῶτος*, back.)

*Squalus acronotus*, POEY, Memorias, II, 335, 1861, Havana.

### 43. CARCHARHINUS PEREZI, (Poey).

Snout rounded, its length from mouth ⅔ width of mouth, and about equal to length of mouth (measured from the line connecting the angles); teeth oblique, with a deep notch on outer margin; lower teeth narrow; Nostril with a small, sharp lobe. Pectoral falciform, rather large. First dorsal acute, inserted near tip of pectoral; anal opposite second dorsal, which has a base nearly ½ as long as that of first dorsal. Gray, tips of fins dusky. Cuba. (Named for Don Laureano Perez, of the University of Madrid.)

*Platypodon perezi*, POEY, Enumeratio, 195, 1875, Cuba.

### 44. CARCHARHINUS REMOTUS, (Valenciennes).

Muzzle rounded, the preocular length equal to the interorbital area; snout before mouth equal to width of mouth; upper teeth oblique with a reëntrant angle, the lower narrow; first dorsal a little higher than long, commencing close behind pectorals; second dorsal lower than anal, the interspace between dorsals nearly 3 times base of anal; distance from first dorsal to ventrals greater than length of first dorsal; pectorals 1⅔ times as long as broad, the posterior margin concave; the outer angle rounded; caudal 5⅕ in length. Color gray. Martinique. (Duméril.) (*remotus*, remote; the ventrals remote from the first dorsal.)

*Carcharias remotus*, Valenciennes, in Duméril's Hist. Nat. Poiss., i., 374, 1870, Martinique.

### 45. CARCHARHINUS HENLEI, (Valenciennes).

Snout produced, the distance between its extremity and the mouth being more than the width of the mouth, upper teeth oblique, notched on the outer margin; lower teeth narrow, nearly erect. Pectorals short, not reaching end of dorsal, their lower margin ⅖ length of upper. First dorsal very small and short, its base much shorter than that of anal. Uniform gray. (Günther.) Coast of Brazil and northward to Guiana. (Named for Dr. J. Henle.)

*Carcharias henlei*,* Valenciennes, in Müller & Henle, Plagiostomen, 46, 1838, Guiana.
*Carcharias porosus*,* Ranzani, Nov. Pisc. Diss. Prima., 70, 1838, Brazil.
*Carcharias porosus*, Günther, Cat., viii, 365, 1870.

## Subgenus CARCHARHINUS.

### 46. CARCHARHINUS MILBERTI, (Müller & Henle).

This species differs from *C. platyodon* chiefly in the following respects: Head longer, snout much less obtuse, its length from mouth equal to breadth of mouth; distance between nostrils ⅓ less than length of snout. Teeth and fins as in *C. platyodon*. Pectorals rather small, not falcate, 6½ in body; caudal 4 in body, rather narrow. Cape Cod to Florida; not rare, but very imperfectly described. (Named for M. Milbert, a French naturalist who collected in America.)

*Carcharias* (*Prionodon*) *milberti*, Müller & Henle, Plagiostomen, 38, 1838, New York.
*Carcharias cæruleus*, De Kay, N. Y. Fauna: Fishes, 354, 1842, New York.
*Carcharias cæruleus*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 244.
*Lamna caudata*, De Kay, *l. c.*, 354, 1842, Brenton Reef, Rhode Island.
*Eulamia milberti*, Gill, Proc. Ac. Nat. Sci. Phila., 1864, 262.
*Carcharhinus cæruleus*, Jordan & Gilbert, Synopsis, 872, 1883.

### 47. CARCHARHINUS LAMIELLA, (Jordan & Gilbert).

(Bay Shark.)

Body robust, the back elevated. Head broad and flat; the snout long, but wide and rounded, its length from mouth a little more than width of mouth and greater than distance between nostrils, which are nearer snout than angle of the mouth. Eye moderate. Teeth $\frac{30}{30}$, their form as in *C. lamia*, the upper regularly triangular, without notch, narrow in the young, the lower narrowly triangular, erect, on a broad base; all the teeth distinctly and evenly serrated. First dorsal beginning at a distance $\frac{4}{5}$ its own base behind the pectorals and ending a little more than its base before the ventrals. Space between dorsals $2\frac{3}{5}$ times base of first dorsal, 7 times that of second. Height of first dorsal $\frac{2}{3}$ the depth of the body; pectoral reaching past first dorsal. Second dorsal very small, not $\frac{1}{6}$ the height of the first, smaller than anal and nearly opposite it. Pectorals long and broad, reaching past base of dorsal, $5\frac{2}{3}$ in body. Tail $3\frac{1}{2}$ in length. Color plain light gray. San Diego Bay and southward along the Mexican coast. Very close to *C. lamia*, but the dorsals and pectorals smaller and the first dorsal farther back. (Diminutive of *lamia*.)

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* We do not know which of these two names has priority of date.

*Carcharias lamiella*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 110, San Diego; JORDAN & GILBERT, Synopsis, 873, 1883. (Type, No. 27366.)

## 48. CARCHARHINUS LAMIA,[*] (Rafinesque).

(CUB-SHARK; REQUIN; REQUIEM; LAMIA.)

Head broad, depressed; snout short and rounded, nostrils midway between its tip and the front of the mouth; breadth of mouth $2\frac{1}{3}$ times length of preoral part of snout. First dorsal very large, inserted close behind the base of the pectoral, its height a little greater than the length of its base, its anterior margin convex, its upper angle rounded, its posterior border nearly straight, its lower angle pointed, its height about equal to greatest depth of body; second dorsal much smaller than first, about equal to anal; pectorals at least twice as long as broad, 5 times in body; upper lobe of caudal $\frac{1}{4}$ the total length, twice the inferior lobe. Grayish, fins rarely darker at tip. L. 10 feet. Tropical parts of the Atlantic; common northward to Florida Keys, abundant in the Caribbean Sea and in the Mediterranean; a man-eating shark, notorious in warm regions as a greedy scavenger about wharves. (*λαμία*, lamia, sea-monster, from *λαιμός*, devouring hunger.) (EU.)

*Canis carcharias*, *Lamia* or *Requin* of early writers.
*Squalus carcharias* of most early French and Italian writers, not of Linnæus.
*Carcharias lamia*, RAFINESQUE, Indice d'Ittiol. Sicil., 44, 1810, Sicily, (after Lacépède).
*Carcharhinus commersoni*, BLAINVILLE, Bull. Sci. Philom., 1816, 121, (based on Lacépède's figure of *Squalus carcharias*.)
*Squalus carcharias*, CUVIER, Règne Animal, based on *Canis carcharias* of Bellonius.
*Carcharias lamia*. RISSO, Hist. Nat. Europ. Merid., III, 119, 1826, Nice.
*Squalus longimanus*, POEY, Memorias, II, 338, 1861, Cuba.
*Eulamia longimana*, POEY, Synopsis, 48, 1868.
*Eulamia lamia*, POEY, Enumeratio, 188, 1875.
*Carcharias lamia*, GÜNTHER, Cat., VIII, 372, 1870; JORDAN, Proc. U. S. Nat. Mus., 1884, 104.

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[*] *Carcharhinus leucos*, (Valenciennes): Pectorals rather long, but shorter than in *C. lamia;* first dorsal with pointed angles, its anterior border not convex, and its posterior border little excavated (Duméril); otherwise about as in *C. lamia*, with which it is probably identical. West Indies; Algiers. (λευκός, white.)

*Carcharias leucos*, Valenciennes, in Müller & Henle's Plagiostomen, 42, 1838, Antilles; Duméril Hist. Nat. Poiss., 358.

### 49. CARCHARHINUS PLATYODON, (Poey).

Body stout; head very short, broad, depressed, and bluntly rounded; mouth twice as broad as long, its breadth about ½ more than length of snout; upper teeth very broad, triangular, erect, coarsely serrate, not notched; lower teeth narrower, more finely serrate. First dorsal beginning close behind pectoral, a little higher than long, not falcate, its base 2⅓ in interspace between dorsals; second dorsal very small, its base 5 in interspace; caudal moderate, 2⅔ in body; anal a little longer than second dorsal, and placed a little farther back; pectorals rather small, not falcate, 6 in total length, reaching a little past front of dorsal; width of pectoral nearly ⅔ of its length. Slaty blue, white below; caudal blackish, other fins with dark tips. L. 10 to 15 feet. Cuba to Texas; abundant in the Gulf of Mexico; the specimen here described being from Galveston. (*πλατύς*, broad; *ὀδούς*, tooth.)

*Squalus platyodon*, Poey, Memorias, ii, 331, 1861, Havana.
*Squalus obtusus*, Poey, *l. c.*, 337, Havana.
*Carcharias platyodon*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 243; Synopsis, 872,1883.

### 50. CARCHARHINUS FRONTO, (Jordan & Gilbert).

(Tiburon.)

Body short and stout; head very broad, depressed, broadly rounded anteriorly, the front of snout parallel with cleft of mouth; snout from mouth ½ the distance between angles of mouth; and about equal to distance from chin to the line connecting these angles; interorbital width twice length of snout to eyes. Teeth in both jaws narrowly triangular, twice as high as broad, all nearly erect and scarcely notched on outer margin. Free margins of fins concave; insertion of first dorsal nearer pectorals than ventrals; length of base of first dorsal more than its height, but less than interorbital width; interspace between dorsals 2¼ times base of first, 3⅕ times base of second; tail 4¼ in body; anal smaller than second dorsal; pectorals large, not acute, reaching a little past front of dorsal. Slaty gray, the edges of fins brownish. L. 10 feet. Pacific Coast of Mexico; a large voracious shark remarkable for its broad head. (*fronto*, having a wide forehead.)

*Carcharias fronto*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 102, Mazatlan, Mexico. (Type, No. 28167.)

### 51. CARCHARHINUS NICARAGUENSIS, (Gill & Bransford).

(Tigrone.)

Snout short, obtusely rounded; distance from mouth to snout ⅘ distance between nostrils; teeth $\frac{25}{25}$; upper teeth triangular, scarcely notched on outer margin; first dorsal commencing just behind axil of pectoral, its height greater than length of its base; second dorsal larger than anal, its base 2½ in that of first dorsal; pectorals moderate, their length not twice height of dorsal. L. 7 feet. Lake Nicaragua and its outlet, Rio San Juan, abundant, confined so far as known to fresh waters, the only strictly fresh water shark recorded.

*Eulamia nicaraguensis*, Gill & Bransford, Proc. Ac. Nat. Sci. Phila., 1877, 190, Lake Nicaragua, Nicaragua.

### Subgenus ISOGOMPHODON, Gill.

### 52. CARCHARHINUS ÆTHALORUS, (Jordan & Gilbert).

Body robust, the head rather long and pointed in profile, flattish above; snout from mouth equal to distance between angles of mouth, ½ greater than from chin to line connecting these angles; interorbital width slightly more than snout from eye; 3 short furrows from angle of mouth; teeth in both jaws narrowly triangular, nearly erect and scarcely notched on the outer margin, all finely serrate; pores not conspicuous; gill openings large. Free margins of all fins concave. Insertion of first dorsal close behind base of pectoral; length of base of first dorsal less than its height; interspace between dorsals 2 to 2½ times base of first dorsal and 4 times second, which is much smaller than first. Tail about ¼ total length; anal a little longer than second dorsal. Eyes very small. Pectorals somewhat falcate, reaching to opposite posterior part of base of dorsal, their tips pointed; pectoral, 6 in body. Slaty gray; upper edge of tail blackish; tips of all fins blackish. L. 6 feet or more. Mazatlan to Panama; common; very close to *C. limbatus.* (*αἰϑαλή*, soot; *ὅρος*, margin.)

*Carcharias æthalorus*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 104, **Mazatlan.** (Type, Nos. 28202, 29549.)

### 53. CARCHARHINUS LIMBATUS, (Müller & Henle).

(CAÇONETTA.)

Snout somewhat pointed in front, rather produced, the distance between its extremity and the mouth somewhat less than width of mouth; nostrils nearly midway between the extremity of snout and mouth; teeth $\frac{25\text{-}29}{27\text{-}30}$, similar in form in both jaws, erect, constricted, on a broad base, the upper more distinctly serrated than the lower; gill openings wide, at least twice as wide as the eye, which is small. Pectorals falciform, extending beyond end of dorsal, the length of their upper margin being nearly 4 times that of lower. First dorsal commencing very close behind the axil of the pectoral; origins of second dorsal and anal opposite to each other, the bases being nearly equally long. Caudal fin long, its length equal to distance between the origins of the 2 dorsal fins. Color gray, lower side of the extremity of the pectoral, extremities of the second dorsal and anal and of the lower caudal lobe, black. (Günther.) Tropical seas, north to Florida; a stray specimen taken at Woods Holl, Mass.; common in Brazil; used as food by the very poor. (*limbatus*, edged.)

*Carcharias* (*Prionodon*) *limbatus*, MÜLLER & HENLE, Plagiostomen, 49, 1838, **Martinique.**
*Carcharias limbatus*, GÜNTHER, Cat., VIII, 373, 1870.
*Isogomphodon limbatus*, JORDAN & GILBERT, Synopsis, 23, 1883.
*Isogomphodon maculipinnis*, POEY, Repertorio, I, 191, 1867, **Cuba.**
*Carcharias mülleri*, STEINDACHNER, Sitzber. Akad. Wiss. Wien., 1867, 356, **West Indies.**
*Carcharias microps*, LOWE, Proc. Zoöl. Soc., 1840, 38, **Madeira.**
*Prionodon cucuri*, CASTELNAU, Anim. Amér. Sud. Poiss., 99, 1855, **Bahia.**

### 54. CARCHARHINUS OXYRHYNCHUS, (Müller & Henle).

Snout very much elongate, pointed, narrow; distance between mouth and tip of snout about twice distance between nostrils; a short labial fold on each jaw; teeth small, $\frac{46\text{-}49}{48\text{-}49}$, erect, rather slenderer in lower jaw; only the upper teeth show serration near the tip. Pectorals very large and broad, extending beyond dorsal, which begins above root of pectoral. Second dorsal and anal sub-equal, only ½ size of first dorsal. Eye small, gill openings moderate. (Günther.) Surinam. (*ὀξύς*, sharp; *ῥύγχος*, snout.)

*Carcharias oxyrhynchus*, Müller & Henle, Plagiostomen, 41, 1838, Surinam.
*Carcharias oxyrhynchus*, Günther, Cat., VIII, 375, 1870.

## 26. HYPOPRION, Müller & Henle.

*Hypoprion*, Müller & Henle, Plagiostomen, 34, 1838, (*macloti*).
*Hypoprionodon*, Gill, Ann. Lyc. Nat. Hist. N. Y., 1861, 401, (*hemiodon*) (teeth serrate on outer side only).

Characters essentially as in *Carcharhinus*, but with the lower teeth entire, the upper teeth coarsely serrated at base only, on one or both sides; lower teeth erect. (*ὑπό*, below; *πρίων*, saw; the upper teeth being serrated at base).

*a.* Snout obtuse; its length from mouth ½ interorbital width; upper teeth weakly serrate on both sides in adult; second dorsal very large, more than ½ base of first. BREVIROSTRIS, 55.

*aa.* Snout acute; its length from mouth 1⅙ times width of mouth; upper teeth strongly serrate on both sides; second dorsal small, about ½ as long as first. SIGNATUS, 56.

### 55. HYPOPRION BREVIROSTRIS, Poey.

Body robust; head flattened, the snout short, flat, broadly rounded; nostril midway between tip of snout and posterior edge of pupil; preoral part of snout half interorbital width; width of mouth equal to distance from tip of snout to posterior margin of orbit; fold at angle of mouth half orbit; upper teeth broadly triangular, the base finely serrate on outer edge only in young, on both sides in adult; lower teeth erect. Eye small. Second dorsal unusually large, similar to first and nearly as high. Interspace between dorsals 2¼ times base of first, 2⅓ times second; anal about ⅔ size of second dorsal; pectorals moderate, broad, nearly reaching middle of first dorsal. Gray, fins dusky in young, inside of mouth brilliant white. L. 7 feet. West Indies, north to Charleston, not rare at Key West, where it frequents the wharves with its more dangerous relative, *Carcharhinus lamia*. (*brevirostris*, short-nosed.)

*Hypoprion brevirostris*, Poey, Repertorio, II, 451, tab. 4, 1868, Cuba; Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 581; Jordan, *l. c.*, 1884, 104.

### 56. HYPOPRION SIGNATUS,* Poey.

Snout long, acute, the preoral length 1⅙ times width of mouth; nostrils with a short, acute lobe; pectoral acute, not falciform; second dorsal opposite anal, neither ½ base of first dorsal; upper teeth strongly serrate at base, the claw sharp and nearly erect. Cuba. (Poey, description of *longirostris*.) (*signatus*, marked.)

*Hypoprion signatus*, Poey, Synopsis, 452, 1868, Cuba; Poey, Enumeratio, 199, 1875.
*Hypoprion longirostris*, Poey, Enumeratio, 199, 1875, Cuba.

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*Poey has given names to 2 species of *Hypoprion* with the snout long, the 2 differing only in form of the teeth. These are *longirostris*, described as above, and *signatus*, known from the teeth only. The upper teeth of *signatus*, according to Poey, have the claw triangular and bluntish, the lower teeth bluntish, not flexuous, and somewhat oblique. Probably the 2 are not different species, and *signatus* is the older name.

## 27. APRIONODON, Gill.

*Aprion*, Müller & Henle, Plagiostomen, 32, 1838, preoccupied, (*isodon*).
*Aprionodon*, Gill, Ann. Lyc. Nat. Hist. N. Y., vii, 1861, 411, (*punctatus* = *isodon*).

Snout more or less produced and conic; teeth entire, without serræ, all of them narrowed, on a broad base, the lower erect, the upper erect or slightly oblique; dorsal more or less posterior, opposite the space between pectorals and ventrals. (*ἀ*-, privative; *πρίων*, saw; *ὀδούς*, tooth; the edges of the teeth being always entire.)

### 57. APRIONODON ISODON, (Müller & Henle).

Snout short, little pointed; distance from angle of mouth to nostril twice that from nostril to end of snout; pectorals reaching end of first dorsal, which is much longer and higher than second. Grayish. (Duméril.) Atlantic Ocean, recorded from New York, Virginia, and Cuba; probably rare. (*ἴσος*, equal; *ὀδούς*, tooth).

*Carcharias isodon*, Müller & Henle, Plagiostomen, 32, 1838, New York.
*Carcharias punctatus*, Günther, Cat., viii, 361, 1870, New York, (not *Squalus punctatus*, Mitchill, which is *Scoliodon terræ-novæ*).
*Aprionodon isodon*, Poey, Enumeratio, 200, 1875.
*Carcharias isodon*, Duméril, Elasmobranches, 349, 1870.

## 28. SCOLIODON, Müller & Henle.

*Scoliodon*, Müller & Henle, Wiegmann's Archiv. f. Naturg., iii, 1837, (*laticaudus*).

Teeth entire or very nearly so, oblique and flat, the points directed toward the sides of the mouth, so that the inner margins are more or less nearly horizontal, the teeth in front more nearly erect; teeth not swollen at the base, each of them with a deep notch on the outer margin below the sharp point; lips with conspicuous grooves. Otherwise as in *Carcharhinus*, from which the genus is scarcely distinct. Size small. (*σχόλιος*, oblique; *ὀδούς*, tooth.)

*a.* Teeth minutely serrulate above in the adult, less oblique than in the next; snout sharp, its length from mouth greater than width of mouth. longurio, 58.
*aa.* Teeth entire, all very oblique; snout not sharp, its length from mouth less than width of mouth. terræ-novæ, 59.

### 58. SCOLIODON LONGURIO, (Jordan & Gilbert).

Snout much produced, sharp, its length from mouth 1¼ times width of mouth; labial folds well developed, that on upper jaw reaching about ⅓ distance to middle of jaw, the lower fold ½ as long; upper teeth broadly triangular, minutely serrated, serrulate on both margins; lower teeth entire, suberect, less oblique than in *S. terræ-novæ*. Pectorals short, not reaching end of first dorsal; first dorsal large, close behind pectorals, its base 2¼ in interspace between dorsals; second dorsal very small, over anal, which is nearly twice its length; base of anal nearly ½ that of first dorsal. Dark gray, the young with the fins dusky edged. Pacific Coast of Mexico; not rare. (*longurio*, a slender youth, or stripling.)

*Carcharias longurio*, Jordan & Gilbert. Proc. U. S. Nat. Mus., 1882, 106, Mazatlan. (Type, Nos. 28306, 28330, 28331, 29541, 29551.)

### 59. SCOLIODON TERRÆ-NOVÆ, (Richardson).

(Sharp-nosed Shark.)

Body slender; snout depressed, moderately rounded; mouth U-shaped, with a short labial groove at its angle, which groove extends on the upper jaw as well as on the lower; distance between nostrils greater than distance from nostrils to end of snout; gill openings narrow; first dorsal moderate, midway between pectorals and ventrals; second dorsal very small, slightly behind, and rather smaller than anal; anal fin much shorter than distance from anal to ventrals; pectoral fins rather large, reaching about to middle of first dorsal; ventrals small. Color gray; caudal fin with a conspicuous narrow blackish edge. Cape Cod to Brazil, very common southward along the Atlantic Coast. Size rather small. L. 3 feet. (Name from Newfoundland, where the species was erroneously supposed to occur.)

*Squalus (Carcharias) terræ-novæ*,* Richardson, Fauna Bor. Amer., iii, 289, 1836, Newfoundland.
*Carcharias terræ-novæ*, Günther, Cat., viii, 360, 1870.
*Squalus punctatus*, Mitchill, Trans. Lit. & Phil. Soc. N. Y., 1, 483, 1815, New York; name preoccupied.
*Carcharias lalandi*, Müller & Henle, Plagiostomen, 30, 1838, Brazil.

## Family XII. SPHYRNIDÆ,

(The Hammer-headed Sharks.)

General characteristics of the Galeidæ, but the head singularly formed, kidney-shaped or "hammer"-shaped, from the extension of its sides, the nostrils being anterior and the eyes on the sides of the "hammer"; mouth crescent-shaped, under the "hammer"; teeth of both jaws similar, oblique, each with a notch on the outside near the base; no spiracles; last gill opening over the pectoral; first dorsal and pectorals large, the dorsal nearer pectorals than ventrals; second dorsal and anal small; a pit at the root of the caudal; caudal fin with a single notch toward its tip, its lower lobe developed. One genus with 5 species, inhabiting most warm seas. Large sharks, known at once by the singular form of the head, which is not quite the same in any two species. (Carchariidæ, part, group Zygænina, Günther, Cat., viii, 380–383.)

### 29. SPHYRNA, Rafinesque.

(Hammer-head Sharks.)

*Sphyrna*, Rafinesque, Indice d' Ittiol. Siciliana, 60, 1810, (*zygæna*).
*Cestrorhinus*, Blainville, Journ. Phys., 264, 1816, (*zygæna*).
*Zygæna*, Cuvier, Règne Animal, Ed. 1, 127, 1817, (*zygæna*; name preoccupied).
*Platysqualus*, Swainson, Classn. Anim., ii, 318, 1839, ("*tiburo*"=*tudes*).
*Cestracion* (Klein: pre-Linnæan), Gill, Ann. Lyc. Nat. Hist. N. Y., viii, 1861, 412, (*zygæna*).
*Eusphyra*, Gill, *l. c.*, (*blochii*).
*Reniceps*, Gill, *l. c.*, (*tiburo*).

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*This species, with others belonging to the Florida fauna, is said by Richardson to have been brought from Newfoundland by Audubon. They doubtless came from some locality in Florida or Carolina.

Characters of the genus included above. In the form of the head, there is a perfect gradation among the species from the narrow hammer of *S. blochii*, with the lobes 3 times as long as broad and deeply grooved along the anterior edge, to the kidney-shaped head of *S. tiburo*, in which the anterior grooves are obsolete. (*σφῦρα*, hammer.)

*a.* Nostrils near the eyes.

*b.* Nostril with the frontal groove short or obsolete; lateral extension of head moderate so that the head is rather kidney-shaped than hammer-shaped.

*c.* RENICEPS, (*rena*, kidney; *ceps*, head): Nostril with the groove obsolete; anterior and lateral margins of head confluent into a semicircle. TIBURO, 60.

*cc.* PLATYSQUALUS, (*πλατύς*, broad; *squalus*): Nostril with a short groove; anterior margin of head curved, not continuous with lateral edges. TUDES, 61.

SPHYRNA:

*bb.* Nostril with a well-developed groove, which extends along the front of the hammer-shaped head, the anterior and posterior outlines of which are nearly parallel. ZYGÆNA, 62.

### Subgenus RENICEPS, Gill.

### 60. SPHYRNA TIBURO, (Linnæus).

(SHOVEL-HEAD SHARK; BONNET-HEAD.)

Body rather slender, not much compressed; head depressed, semicircular in front, reniform, the posterior free margins short, the lateral margins continuous with the anterior; pectorals large; first dorsal high, midway between pectorals and ventrals; second dorsal much smaller, produced behind, higher and shorter than anal; ventral fins moderate; caudal moderate; mouth small, crescentic; teeth small, very oblique, with a deep notch on the outer margin. Head 4½ in length, 6 to tip of caudal; width of head slightly less than length of head. Color uniform ashy, paler beneath. L. 3 to 5 feet. Atlantic Ocean; abundant on our coast from Long Island southward; ranging to China. (*tiburo*, shark, in Spanish.)

*Squalus tiburo*, LINNÆUS, x, 1758, 234, America.
*Zygæna tiburo*, GÜNTHER, Cat., VIII, 382, 1870.
*Reniceps tiburo*, JORDAN & GILBERT, Synopsis, 25, 1883.

### Subgenus PLATYSQUALUS, Swainson.

### 61. SPHYRNA TUDES, (Cuvier).

Intermediate in all respects between *S. zygæna* and *S. tiburo*, the head longer and the hammer less produced laterally than in the former. Anterior margin of the head much curved, but not continuous with the lateral edge; length of hinder margin of one side of the hammer less than its width near the eye. Nostril close to the eye, its groove longer than in *S. tiburo*, but very short, continued for but a short distance along the side of the head, and followed by a line of pores. A large shark, of the warm seas; Gulf of California, West Indies, Mediterranean, and Indian Ocean. (*tudes*, hammer.) (EU.)

*Zygæna tudes* (CUVIER MS.), VALENCIENNES, Mém. Mus., IX, 225, 1822, Nice, after Pantouflier of Risso.
*Sphyrna tudes*, MÜLLER & HENLE, Plagiostomen, 53, 1838.
*Zygæna tudes*, GÜNTHER, Cat., VIII, 382.
*Sphyrna tudes*, JORDAN & GILBERT, Bull. U. S. Fish Com., 1882, 105.
*Sphyrna tudes*, JORDAN, Cat. Fish. N. A., 9, 1885.

### Subgenus SPHYRNA.

### 62. SPHYRNA ZYGÆNA, (Linnæus).

(Hammer-headed Shark.)

Head truly hammer-shaped; width of head about twice its length; length of hinder margin of hammer nearly equal to its width near the eye; nostril close to eye, prolonged into a groove which runs along nearly the whole front margin of head; first dorsal large; second quite small, smaller than anal; pectoral rather large. Color gray. A large voracious shark, reaching a length of 15 feet or more, found in all warm seas; occasional on our coasts from Cape Cod and from Point Concepcion southward. (*ζύγαινα*, *Zygæna*, the ancient name, from *ζυγόν*, yoke.) (Eu.)

*Squalus zygæna*, Linnæus, Syst. Nat., Ed. x, 1758, 234, Europe; America.
*Squalus malleus*, Risso, Ichth. Nice., 34, 1810, Nice.
*Zygæna malleus*, Storer, Fish. Mass., 238, 1867.
*Sphyrna zygæna*, Jordan & Gilbert, Synopsis, 25, 1883.
*Zygæna lewini*, Lord in Griffith, Animal Kingdom, x, 640, 1834, New Holland.
*Zygæna subarcuata*, Storer, Proc. Bost. Soc. Nat. Hist., 1848, 70, Cape Cod.

## Family XIII. ALOPIIDÆ.

(The Thresher Sharks.)

Body moderately elongate, the snout rather short; mouth crescent-shaped; teeth equal in both jaws, moderate sized, flat, triangular, not serrated; the third tooth of the upper jaw on each side much smaller than the others; gill openings moderate, the last one above the root of the pectorals; no nictitating membrane; spiracles just behind eye, minute or absent; first dorsal large, midway between pectorals and ventrals; second dorsal and anal very small; caudal fin exceedingly long, about as long as the rest of the body, a pit at its root, a notch on the upper lobe near its tip; lower lobe moderately developed; no caudal keel; ventrals rather large; pectorals very large, falcate. A single species, reaching a large size, inhabiting most seas, known at once by the great length of the tail. (*Lamnidæ*, part, Günther, viii, 393; genus *Alopecias*.)

### 30. ALOPIAS, Rafinesque.

(Thresher Sharks.)

*Alopias*, Rafinesque, Caratteri di Alcuni Generi, etc., 12, 1810, (*macrourus*=*vulpes*).
*Alopecias*, Müller & Henle, Plagiostomen, 74, 1838, amended orthography.

The characters of the genus are included above. (*ἀλωπός*, a fox, Latin, *vulpes*. *A. vulpes* was known to the ancients as *ἀλωπεκίας*, fox-like).

### 63. ALOPIAS VULPES, (Gmelin).

(Thresher; Fox-shark; Swingle Tail; Long-tail Shark.)

A large shark, abounding in all warm seas, especially in the Mediterranean and Atlantic. It is also frequently taken on our Pacific coast. (*vulpes*, fox.) (Eu.)

*Squalus vulpes*, Gmelin,* Syst. Nat., I, 1496, 1788, Mediterranean, (after Pennant).
*Squalus vulpinus*, Bonnaterre,* Tableau Encycl. Icthy., 9, 1788, Mediterranean, (after Pennant).
*Alopecias vulpes*, Günther, Cat., VIII, 393, 1870.
*Alopias vulpes*, Jordan & Gilbert, Synopsis, 27, 1883.
*Alopias macrourus*, Rafinesque, *l. c.*, 1810, 12, Sicily.
*Squalus alopecias*, Gronow, Cat. Fishes, 7, 1854.

## Family XIV. CARCHARIIDÆ.

### (The Sand Sharks.)

Body rather elongate, the snout sharp; mouth crescent-shaped, wide; the teeth large, long, narrow, and subulate, most of them with 1 or 2 small cusps at the base, their edges entire; gill openings rather large, all of them in front of the pectorals; two dorsals, moderate, subequal; the anal similar; first dorsal well behind pectorals; caudal well developed, with a short basal lobe and a notch toward its tip; no caudal keel; pectorals rather short; no nictitating membrane; spiracles minute, pore-like. A single genus, with 3 recognized species. A number of fossil species belong to this family. Voracious sharks of moderate size, chiefly inhabiting the Atlantic. (Lamnidæ, part, Günther, Cat., VIII, 392; genus *Odontaspis.*)

## 31. CARCHARIAS, Rafinesque.

*Carcharias*, Rafinesque,† Caratteri di Alcuni Nuovi Generi, 10, 1810; in part, the only species mentioned, *taurus*, belongs here. (See note under *Carcharhinus.*)
*Odontaspis*, Agassiz, Poissons Fossiles, III, 87, 1836, (*ferox*).
*Triglochis*, Müller & Henle, Mag. Nat. Hist., 1837, II, 88, (*ferox*).
*Eugomphodus*, Gill, Proc. Ac. Nat. Sci. Phila., 1864, 260, (*littoralis*).

Characters of the genus given above. (*καρχαρίας*, a rough shark.)

*a.* Teeth large, awl-shaped, most of them with 1 or 2 small cusps at base.

Eugomphodus, (εὖ, true; γόμφος, nail; ὀδούς, tooth):

*b.* First and fourth teeth of upper jaw and first tooth of the lower simple, without basal cusps. littoralis, 64.

### Subgenus EUGOMPHODUS, Gill.

### 64. CARCHARIAS LITTORALIS, (Mitchill).

### (Sand Shark.)

Body elongate, its depth $\frac{1}{5}$ the length; head rather pointed, about $\frac{1}{7}$ of the length; fins small, the first dorsal not much longer than the second, both similar to the anal; pectoral fins short, obtuse or truncate. Color gray. L. 5 feet. A small voracious shark with very sharp teeth, rather common on our Atlantic coast, especially between Cape Cod and Cape Hatteras, said to differ from the European *C. taurus* in its more anterior dorsal; the two species need further comparison. (*littoralis*, pertaining to the shore.)

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* The general works of Dr. J. F. Gmelin and the Abbé Bonnaterre bear the same date, 1788. We do not know which is the earlier, and follow common usage in retaining in this and other cases the name given by Gmelin. Neither writer mentions the other. Gmelin's preface is dated March 16, 1788, while the page devoted by Bonnaterre to the "Privilège du Roi" bears date of May 16, 1788. Bonnaterre states that there have been thirteen editions of Linnæus' Systema Naturæ. Of these the thirteenth is the work of Gmelin. But there is no evidence that Bonnaterre had seen or used this thirteenth edition, or that the latter had appeared when his own work was published. The two works were nearly simultaneous in appearance, but there is a slight probability in favor of Gmelin. Gmelin's names have been generally used by subsequent authors, while those of Bonnaterre have been almost totally ignored.

† *Carcharias*, Rafinesque, was established for those sharks, "the most enormous and most voracious of their order, which differ from the genus *Galeus*, Rafinesque, by the lack of spiracles." The group corresponds to the first subgenus under *Squalus*, in the arrangement of Lacépède. The type of this subgenus is *Squalus carcharias*, which was identified by Rafinesque with *Carcharhinus lamia*. *Carcharias lamia* should, therefore, have been designated as the type of *Carcharias*, but Rafinesque failed to so indicate, and we leave the name with the only species he mentions.

*Squalus americanus*, MITCHILL, Trans. Lit. and Phil. Soc., 1815, I, 483, New York, (not of Shaw).
*Squalus littoralis*, and *S. macrodus*, MITCHILL, Am. Monthly Mag., II, 1818, 328, New York.
*Carcharias griseus*, AYRES, Bost. Jour. Nat. Hist., 1844, 288, Long Island.
*Odontaspis americanus*, GÜNTHER, Cat., VIII, 392, 1870.
*Eugomphodus littoralis*, GILL, Proc. Ac. Nat. Sci. Phila., 1864, 260.
*Carcharias americanus*, JORDAN & GILBERT, Synopsis, 27, 1883.

## Family XV. LAMNIDÆ.

### (THE MACKEREL SHARKS.)

Sharks of large size, with the body stout, the mouth wide, with large teeth, and the tail slender, the caudal fin lunate, the 2 lobes being not very unequal, the upper lobe strongly bent upward; caudal peduncle with a strong keel on each side; gill openings wide, all in front of the pectorals, entirely lateral, not extending under the throat; first dorsal large; pectorals large; ventrals moderate; second dorsal and anal very small; a pit at the root of the caudal; spiracles minute or absent. Genera 3; species 6 or more, besides numerous fossil species. In this family the dentition, as well as the muscular system, reaches its highest degree of specialization. (LAMNIDÆ, part, Günther, Cat., VIII, 389–392.)

*a.* LAMNINÆ. Teeth slender and sharp, with entire edges.
  *b.* Teeth without basal cusps, long, flexuous, and acute. ISURUS, 32.
  *bb.* Teeth, or most of them, with a small cusp on each side at base, compressed, sharp, and somewhat triangular. LAMNA, 33.
*aa.* CARCHARODONTINÆ. Teeth with serrated edges, compressed, and triangular in form, without basal cusp. CARCHARODON, 34.

## 32. ISURUS, Rafinesque.

*Isurus*, RAFINESQUE, Caratteri di Alcuni Nuovi Generi, 11, 1810, (*oxyrhynchus*).
*Oxyrhina*, AGASSIZ, Poissons Fossiles, III, 276, 1836, (*spallanzanii = oxyrhynchus*).
*Isuropsis*, GILL, Ann. Lyc. Nat. Hist. N. Y., VIII, 153, 1861, (*glaucus*).

Snout rather long and pointed; the body formed much like that of a tunny or mackerel; first dorsal and pectorals large; second dorsal and anal very small; caudal peduncle slender; teeth long, lanceolate, with sharp entire cutting edges and no basal cusps. (*ἴσος*, equal; *οὐρά*, tail; the two lobes of the tail being nearly equal, as in all the members of this family.)

ISUROPSIS, (ἴσος, equal; οὐρά, tail; ὄψις, appearance):
*a.* First dorsal inserted entirely behind pectorals, nearly midway between pectorals and ventrals.
  *b.* Height of dorsal $1\frac{3}{4}$ in head; pectoral as long as head. DEKAYI, 65.
ISURUS:
*aa.* First dorsal inserted close behind pectorals. OXYRHYNCHUS, 66.

### Subgenus ISUROPSIS, Gill.

### 65. ISURUS DEKAYI, (Gill).

(Mackerel Shark.)

Head 5 in length to tip of caudal; pectoral as long as head, a little longer than upper caudal lobe. Dorsals and pectorals falcate; first dorsal inserted behind pectoral at a distance equal to ¼ head; base of first dorsal 2⅓ in head, its height 1¾. Middle teeth very long, much longer and narrower than lateral teeth. Dark bluish gray above, white below, the color abruptly changing on the tail; upper fins dusky, lower pale. L. 10 feet. Cape Cod to West Indies, not common; described here from a specimen taken at Pensacola. The American species seems to differ from the Asiatic *I. glaucus* in its longer pectorals and higher dorsal. (Named for James E. De Kay, author of the Fauna of New York.)

*Lamna punctata*, De Kay, N. Y. Fauna: Fishes, 352, 1842, New York, (not *Squalus punctatus*, Mitchill).

*Isuropsis dekayi*, Gill, Ann. Lyc. Nat. Hist. N. Y., 1861, 153, after De Kay.

*Isuropsis glaucus*, Poey, Synopsis, 446, 1868 (not *Oxyrhina glauca*, Müller & Henle).

*Isurus dekayi*, Jordan & Gilbert, Synopsis, 874, 1883.

### Subgenus ISURUS.

### 66. ISURUS OXYRHYNCHUS, Rafinesque.

(Mackerel Shark; Pesce Tondo; Cane di Mare.)

Muzzle long and pointed, the preoral portion of the snout as long as the cleft of the mouth and greater than interorbital space; snout in the form of a cone flattened below; spiracles very small. Teeth $\frac{13}{13}$ on each side, long, lanceolate, without basal cusps; third tooth on each side of upper jaw much smaller than that next to it. Gill openings very wide, the width of the first rather more than its distance from the last. Origin of dorsal close behind base of pectorals, which are falciform, the length of the lower margin ¼ that of the upper; second dorsal very small, opposite the anal and of the same size; caudal lunate, the upper lobe ¼ longer than the lower. Size very large. A voracious shark, similar in habits to *Isurus dekayi*, from which it differs in the backward position of the dorsal; from *Lamna cornubica* it is separated by the absence of lateral denticles on the teeth. Mediterranean Sea and neighboring parts of the Atlantic, probably occasionally straying to our coast, as the description of the large shark published by Capt. Nathaniel E. Atwood, under the name of *Carcharias tigris*,* could refer to no other known species. (ὀξύς, sharp; ῥύγχος, snout.) (Eu.)

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* Capt. Atwood describes this specimen, which was 8 feet 10 inches in length, as dark blue above, an irregular lead-colored lateral band; belly white. Largest teeth 1¼ inches long, ¼ inch broad at base, smooth (edged) and curving upward. Snout pointed, 2 feet long, from first gill opening: branchial apertures 9 inches long, the distance from first to last 5 inches; 7¼ inches between the eyes; nostrils 2¾ inches before eyes. Front of first dorsal 3 inches behind pectorals; it is 13 inches high and 12 long at base, the free posterior edge 2¾ inches. Second dorsal 25 inches behind posterior root of first, 2¼ inches high, 4 inches long; pectorals 23 inches high, 11½ broad at base; ventrals inserted at a point midway between the two dorsals; anal similar to second dorsal, inserted an inch farther back. Upper lobe of caudal 23 inches long, lower 18; the distance between the tips 31 inches. "The first specimen of this very rare shark was brought from the Gulf of Mexico and presented to the State Cabinet, the second was taken at Truro and presented to the Museum of Comparative Zoölogy; the third, which had bitten off and swallowed large portions of a sword fish, was captured in 1864, at Provincetown and given to the (Boston) Society; a fourth specimen, and the one described above, at Provincetown in August last."—*Atwood.*

*Cane di mare di Messina*, Spallanzani, Viaggio due Sicilie, iv, 325, 1797, Messina.
*Isurus oxyrhynchus*, Rafinesque, Caratteri, etc., 12, 1810, Palermo.
*Isurus spallanzani*, Rafinesque, Indice, 60, 1810, (after Spallanzani).
*Oxyrrhina spallanzani*, Bonaparte, Fauna Italica, xxvi, 134, pl. 136, f. 1, 1839.
*Oxyrhina gomphodon*, Müller & Henle, Plagiostomen, 68, 1838, Atlantic Ocean.
*Squalus rostratus*, Macri, Mem. Ac. Sci. Napoli, 55, 1819, Naples.
*Lamna spallanzani*, Günther, Cat., viii, 390, 1870.
*Oxyrhina spallanzani*, Duméril, Elasmobranches, 408, 1870.
*Carcharias tigris*, Atwood, Proc. Bost. Soc. Nat. Hist., xii, 268, 1869, Provincetown, Mass.

## 33. LAMNA, Cuvier.

(Porbeagles.)

*Lamna*, Cuvier, Règne Animal, Ed. i, 126, 1817, (*cornubicus*).
*Lamia*, Risso, Eur. Merid., 123, iii, 1826 (*cornubicus*, name preoccupied).
*Selanonius*, Fleming, British Animals, 169, 1828, (*walkeri*=*cornubicus*).

Body short and stout, the back considerably elevated; snout prominent, pointed; teeth triangular, pointed, entire, each one with a small cusp on each side at base; one or both of these sometimes obsolete on some of the teeth in the young; gill openings wide; dorsal and pectoral fins somewhat falcate; second dorsal and anal fins very small, nearly opposite each other; first dorsal close behind the root of the pectorals. This genus is very close to *Isurus*, with which fossil forms seem to connect it. Perhaps the two should be united under the older name *Isurus*. (*λάμνα*, a kind of shark, from *λαμία*, a horrible anthropophagous monster, a bugbear used by the Greeks to frighten refractory children.)

### 67. LAMNA CORNUBICA, (Gmelin).

(Porbeagle; Mackerel Shark.)

Snout conical, pointed, rather longer than the cleft of the mouth; teeth $\frac{12-14}{10-14}$ on each side; the third tooth on each side in the upper jaw small; first dorsal beginning over the axil of the pectorals. Color bluish gray. A large and fierce pelagic shark reaching a length of 10 feet. North Atlantic and North Pacific, occasionally taken on the coast of New England and southward; not rare in California. (*cornubicus*, from Cornwall, from which region the species was early described.) (Eu.)

*Squalus cornubicus**, Gmelin, Syst. Nat., i, 1497, 1788, shores of Cornwall.
*Lamna cornubica*, Günther, Cat., viii, 389, 1870; Jordan & Gilbert, Synopsis, 30, 1883.
*Squalus nasus*, Bonnaterre, Tableau Encycl., Ichth., 10, 1788, Cornwall, after Beaumaris of Pennant.
*Squalus pennanti*, Walbaum, Artedi Piscium, 517, 1792, Cornwall, after Pennant.
*Squalus monensis*, Shaw, Gen. Zoöl., v, 350, 1804, Anglesea.
*Squalus selanonus*, Leach, Edinb. Mem. Wern. Soc., 1819, ii, pl. 1, fig. 2, 55.
*Selanonius walkeri*, Fleming, British Animals, 169, 1828, Lochfyne, Argyleshire, "*Sinus Selanoneus.*"

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*We do not know which of the two names, *cornubicus* and *nasus*, has priority; we follow usage in retaining the name of Gmelin.

## 34. CARCHARODON,* Smith.

### (MAN-EATER SHARKS.)

*Carcharodon*, ANDREW SMITH, Proc. Geol Soc. London, v, 86, 1837, (*capensis*=*carcharias*).

General characters of *Isurus* and *Lamna*, but with a different dentition, the teeth being large, flat, erect, regularly triangular, their edges serrated; first dorsal moderate, nearly midway between pectorals and ventrals; second dorsal and anal very small; pectorals large, ventrals moderate; caudal peduncle rather stout; spiracles minute or absent. Sharks of very large size; the strongest and most voracious of all fishes; pelagic, found in most warm seas. (*κάρχαρος*, rough; *ὀδούς*, tooth.)

### 68. CARCHARODON CARCHARIAS,† (Linnæus).

### (MAN-EATER SHARK; GREAT WHITE SHARK.)

Body stout, depth about 5½ in total length; mouth very large; both jaws with 5 rows of large, triangular, serrated teeth, those in the lower jaw narrower, about $\frac{2}{2}\frac{6}{2}$ in each row; first dorsal somewhat behind pectorals; caudal fin large and strong. Color leaden gray; tips and edges of pectorals black. One of the largest of the sharks, reaching a length of 30 feet. It is found in all temperate and tropical seas, and is occasionally taken on our coasts, both in the Atlantic and the Pacific. One caught near Soquel, California, was about 30 feet long and had a young sea lion, weighing about 100 pounds, in its stomach. (*καρχαρίας*, an old name of *Carcharhinus lamia* and of other man-eating sharks.) (EU.)

*Lamia*, RONDELET, Hist. Poiss., 305, 1558, good figure, Nice, Marseilles.
*Squalus carcharias*,‡ LINNÆUS,§ Syst. Nat., Ed. x, 1758, 235, Europe, after Artedi.
*Carcharias verus*, AGASSIZ, Poiss. Foss., III, 91, 1836.
*Carcharodon rondeleti*, MÜLLER & HENLE, Plagiostomen, 70, 1838, after Rondelet, Mediterranean Sea and Atlantic Ocean.
*Carcharodon rondeleti*, GÜNTHER, Cat., VIII, 392, 1870.
*Carcharias atwoodi*, STORER, Proc. Bost. Soc. Nat. Hist., II, 1848, 71, Provincetown.
*Carcharodon carcharias*, JORDAN & GILBERT, Synopsis, 875, 1883.
*Carcharodon capensis*, SMITH, Ill. Zoöl. S. Africa, pl. 4, 1842, Cape of Good Hope.
*Carcharodon smithi*, BONAPARTE, Selach. Tab. Anal., 9, 1839, after Smith.

## Family XVI. CETORHINIDÆ.

### (THE BASKING SHARKS.)

Sharks of immense size, with the gill openings extremely wide, extending from the back nearly to the median line of the throat, all of them in front of the pectorals; mouth moderate, the teeth very small, numerous, conical, without cusps or serratures; no nictitating membrane; spiracles very small, above the corners of the mouth; first dorsal large, midway between pectorals and ventrals; second dorsal and anal small; caudal fin lunate, the upper lobe considerably the larger; caudal peduncle keeled; pectorals and ventrals large. Brain very small. A single genus, with probably but one species; the largest of living fishes, pelagic, inhabiting the northern seas. (Lamnidæ, part, Günther, viii, 394, genus *Selache.*)

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* One species of this genus, *Carcharodon megalodon*, now extinct, must have reached a far larger size than the living *Carcharodon carcharias*. Its teeth are found in great abundance in tertiary deposits along the coast of South Carolina.

† A good account of this species is given by Dr. W. B. Stevenson, Proc. Vassar Brothers Sci. Soc., Poughkeepsie, 1884, and in the American Naturalist for the same year.

‡ This species, well figured by Rondelet, and described by Artedi, and after him by Linnæus, seems to have been lost sight of by subsequent writers from 1758 to 1836, the various references to *Squalus carcharias*, between Linnæus and Müller & Henle, belonging chiefly to *Carcharias lamia*, The true *Squalus carcharias* of Linnæus is, however, unquestionably the *Carcharodon*.

§ "Jonam Prophetam, ut veteres Herculem trinoctem, in hujus ventriculo tridui spatio, bæsisse verosimile est."—*Linnæus*.

## 35. CETORHINUS, Blainville.

(Basking Sharks.)

? *Tetroras*,* Rafinesque, Caratteri, 11, 1810, (*angiova*).
*Cetorhinus*, Blainville, Journ. Phys., 1816, 264, (*gunneri* = *maximus*).
*Selache*, Cuvier, Règne Animal, Ed. i, 129, 1817, (*maximus*).
*Polyprosopus*, Couch, Hist. Brit. Fish., i, 67, 1861, (*rashleighanus* = *maximus*).

The characters of the genus are included above. (κῆτος, whale; ῥίνη, a shark (*Squatina*), from ῥίνη, a file or rasp, the rough skin of the shark being used for polishing wood and marble.)

### 69. CETORHINUS MAXIMUS, (Gunner).

(Basking Shark; Pélérin; Elephant Shark; Bone Shark.)

Body rugose, the skin very rough with small spines; head small; snout blunt; eyes small; teeth in 6 or 7 rows in each jaw, about 200 in each row; first dorsal large, triangular, over the space between pectorals and ventrals; second dorsal much smaller, rather larger than anal; pectorals long, tail large. Gill rakers slender, long and close set, resembling whalebone (hence the name Bone Shark). Largest of the sharks, reaching a length of nearly 40 feet; found in the Arctic seas, straying southward to Portugal, Virginia, and California. Occasionally taken by whalers in Monterey Bay. It is in general a rare species, but gregarious in the breeding season, numbers swimming together on the surface, sluggishly, like logs. (*maximus*, greatest.) (Eu.)

*Squalus maximus*, Gunner, Trondhjem Selskabskr., iii, 33, 1765, Coast of Norway.
*Selachus maximus*, Storer, Fish. Mass., 229, 1867.
*Selache maxima*, Günther, Cat., viii, 394, 1870.
*Cetorhinus maximus*, Jordan & Gilbert, Synopsis, 31, 1883.
*Squalus gunnerianus*, Blainville, Jour. de Phys., 1810, 256, after Gunner.
*Squalus pelegrinus*, Blainville, *l. c.*, 1810, 257, Europe.
*Squalus homianus*, Blainville, *l. c.*, 1810, 257, after Everard Home.
*Cetorhinus shavianus*, Blainville, *l. c.*, 1816, 264, after Shaw.
*Squalus isodus*, Saverio Macri, Mem. della R. Ac. Sci. Napoli, 1819, i, 55, pl. 1, fig. 1, and pl. 2, fig. 2, Naples.
*Squalus elephas*, Le Sueur, Jour. Ac. Nat. Sci. Phila., ii, 343, 1821, New Jersey.
*Squalus cetaceus*, Gronow, Cat. Fishes, 6, 1854, Norway.
*Squalus rashleighanus*, Couch, Trans. Linn. Soc., xiv, 91, 1825, Cornwall, (a monstrosity).
*Acanthias blainvillei*, Capello, Plagiostomos, i, 21, 1866.
*Polyprosopus macer*, Couch, Hist. Brit. Fishes, 1, 67, 1861, England.

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*The description of *Tetroras* is apparently taken from hearsay, and applies to no known shark. It comes nearest the present species, but may be mélange of *Isurus* and *Heptranchias*. We have therefore hesitated to substitute *Tetroras* for *Cetorhinus*. *Tetroras angiova* is described as having "two dorsals; one anal; four gill openings; tail unequal, oblique; snout blunt; teeth rasp like; a keel on each side of tail; eyes very small; gill openings rather large; length about 6 feet. Called *Angiova* at Palermo," The name *Anciova* is now applied at Palermo to *Heptranchias cinereus*, according to Prof. Doderlein.

## Family XVII. RHINODONTIDÆ.

### (THE WHALE SHARKS.)

Origin of the first dorsal fin somewhat in advance of the ventrals; the second small, opposite the anal; both without spines; a pit at the root of the caudal; lower lobe of the caudal well developed; sides of the tail with a keel; no nictitating membrane; spiracles very small; mouth and nostril near the extremity of the snout; teeth very small and numerous, conical; gill openings wide, the last one above the base of the pectorals. Large sharks, of warm seas. Two species are known, *Rhinodon typicus*, from the Cape of Good Hope, and the following. (RHINODONTIDÆ, Günther, Cat., VIII, 396).

*a.* Teeth each recurved backward and acutely pointed, swollen, and with a heel-like projection in front rising from its base. MICRISTODUS, 36.

### 36. MICRISTODUS, (Gill).

*Micristodus*, GILL, Proc. Ac. Nat. Sci. Phila., 1865, 177, (*punctatus*).

This genus is known from its teeth only. These are described as follows: "The teeth are fixed and extremely minute, the largest little more than a line in length (in a shark 20 feet long) and decrease towards the ends of the jaw; they are disposed in regularly transverse rows, of which there are 164 to 167 on each side, while in front there are 13 to 16 in each transverse row; each tooth is recurved backward and acutely pointed, swollen, and with a heel-like projection in front rising from its base." (Gill.) (*μικρός*, small; *ἱστός*, an upright projection; *ὀδούς*, tooth.)

#### 70. MICRISTODUS PUNCTATUS, Gill.

A very large shark found in the Gulf of California. No description has been given, and only the teeth are yet known. (*punctatus*, spotted.)

*Micristodus punctatus*, GILL, Proc. Ac. Nat. Sci. Phila., 1865, 177, Gulf of California.

## Order F. CYCLOSPONDYLI.

### (THE CYCLOSPONDYLOUS SHARKS.)

Calcareous lamellæ arranged in one or more concentric series or rings about a central axis in each vertebra. Spiracles present. Anal fin wanting. Dorsal fins 2, with or without spine. As here understood, the order *Cyclospondyli* includes the sharks of the groups called *Cyclospondyli* and *Tectospondyli* by Hasse. The vertebræ in the rays show similar structures, and it is probably from sharks of this group that the Batoidei are descended. (*κύκλος*, circle; *σπόνδυλος*, vertebra.)

#### FAMILIES OF CYCLOSPONDYLI.

*a.* CYCLOSPONDYLI: Vertebræ with the calcareous lamellæ arranged in a ring about the central axis. Pectoral fins normal, not expanded or deeply notched. Anal fin absent; spiracles present; no nictitating membrane; gill openings before pectorals; caudal bent upward, the lower lobe little developed.

*b.* Dorsal fins each provided with a stout spine, the first dorsal far in advance of ventrals. SQUALIDÆ, XVIII.

*bb.* Dorsal fins without spine, the first dorsal over or in advance of ventrals.
  *c.* First dorsal much before ventrals; skin moderately rough. DALATIIDÆ, XIX.
  *cc.* First dorsal opposite ventrals; skin with thorn-like tubercles. ECHINORHINIDÆ, XX.

TECTOSPONDYLI (*τέκτων*, a builder; *σπόνδυλος*, vertebra):
*aa.* Vertebræ with the calcareous lamellæ ranged in several concentric series or rings about a central axis; pectoral fins very large, expanded horizontally and extended forward at base in front, giving the body the form of the flattened disk of the rays; the anterior extension separated from the neck by a deep notch, in which the gill openings lie; no anal fin; dorsal fins small, posterior; mouth broad, anterior. SQUATINIDÆ, XXI.

## Suborder CYCLOSPONDYLI.

### Family XVIII. SQUALIDÆ.

### (THE DOG-FISHES.)

Body more or less elongate. Head depressed. Eyes lateral, without nictitating membrane. Mouth inferior, rather large, arched, a deep groove on each side. Teeth compressed, variously formed. Nostrils inferior, separate; spiracles rather large; gills openings moderate, all in front of the pectoral fins. Dorsal fins 2, each armed with a spine; the first dorsal in front of the ventrals; anal fin wanting; caudal fin with the lower lobe small or obsolete; ventral fins inserted posteriorly, not much before second dorsal. Oviparous.

Genera 6 or more; species about 15; rather small sharks, chiefly of the Atlantic. These sharks represent a comparatively primitive type, apparently not descended from any other existing *Squali*. (SPINACIDÆ, part, Günther, Cat., VIII, 417–425.)

*a.* Body rather elongate; no fold of skin along side of belly; dorsal spines both directed backward.
  *b.* Upper teeth simple, without smaller cusps at base.
    *c.* Teeth alike in both jaws, subquadrate, each with a nearly horizontal cutting edge and a point directed outward. SQUALUS, 37.
    *cc.* Teeth unequal, the upper very small, narrow, and lanceolate, erect, the lower more or less oblique; dorsal spines hidden in the skin. CENTROSCYMNUS, 38.
  *bb.* Upper teeth each with 1 or 2 small cusps at base on each side.
    *d.* Teeth unequal, the upper erect and tricuspid, the lower oblique. ETMOPTERUS, 39.
    *dd.* Teeth equal, very small and pointed. CENTROSCYLLIUM, 40.

### 37. SQUALUS, (Artedi), Linnæus.

*Squalus*, (ARTEDI) LINNÆUS, X, 1758, 233, (includes all sharks).
*Squalus*, RAFINESQUE, Caratteri, etc., 13, 1810, (*acanthias* and *uyato*; first restriction of the name *Squalus*, to species with spiracles and without anal fin).
*Acanthorhinus*, BLAINVILLE, Journal de Physique, 1816, 263, (*acanthias*).
*Acanthias*, RISSO, Europe Méridionale, III, 131, 1826, (*acanthias*).
*Entoxychirus*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 496, (*uyato*).

Body rather slender. Mouth little arched, with a long, straight, deep, oblique groove on each side; no labial fold. Teeth rather small, all simple, equal in the two jaws, their points so much turned aside that the inner margin forms the cutting edge. Spiracles rather wide, just behind the eye. Fins moderately developed, the first dorsal larger than the second, much in advance of the ventral fins, which are behind the middle of the body, although in advance of the second dorsal. Dorsal spines strong, not grooved. Tail scarcely bent upward. Small sharks abounding in the temperate seas; 4 or 5 species known.

The Linnæan genus *Squalus* was first subdivided by Rafinesque, who restricted the name to those species with spiracles and no anal fin, the type being *Squalus acanthias.* This genus must therefore be called *Squalus* and not *Acanthias.* (*squalus*, shark, a word cognate to the Greek *γαλῆ.*)

*a.* Spine of first dorsal about $\frac{2}{5}$ the height of the fin, second about $\frac{3}{5}$; some of the white spots on back usually persistent through life. ACANTHIAS, 71.

*aa.* Spine of first dorsal $\frac{1}{4}$ to $\frac{1}{3}$ the height of the fin, that of the second dorsal about $\frac{1}{2}$; white spots on back usually disappearing with age. SUCKLII, 72.

### 71. SQUALUS ACANTHIAS, Linnæus.

(DOGFISH; PICKED DOGFISH; BONEDOG; SKITTLE-DOG.)

Body slender; snout pointed; head $6\frac{1}{2}$ in length; depth about 8. Dorsal spines rather high, that of the first dorsal about $\frac{2}{5}$ height of fin, the second dorsal spine about $\frac{3}{5}$ height of fin. Slate color above, pale below, back with oblong whitish spots, especially in the young, these rarely all obsolete in the adult. L. 2 to 3 feet; weight 5 to 15 pounds. A small sharp-toothed shark, ranging widely in the Atlantic, very abundant along the shores of the Northern and Middle States and taken as far south as Cuba. From its livers "Dogfish" oil is extracted. It feeds largely on herrings. (*ἀκανθίας*, an old name from *ἄκανθα*, spine.) (EU.)

*Squalus acanthias*, LINNÆUS, Syst. Nat., Ed. x., 1758, I, 233, Coast of Europe.
*Squalus acanthias*, JORDAN & GILBERT, Synopsis, 16, 1883.
*Acanthias americanus*, STORER, Mem. Am. Ac., II, 1846, 506, Massachusetts.
*Acanthias americanus*, STORER, Fish. Mass., 232, 1867.
*Acanthias vulgaris*, RISSO, Eur. Mérid., III, 131, 1826, Nice.
*Acanthias vulgaris*, GÜNTHER, Cat., VIII, 418, 1870.

### 72. SQUALUS SUCKLII, (Girard).

(CALIFORNIA DOGFISH.)

Very similar to the Atlantic species, *S. acanthias*, but with the dorsal spines lower, the first about $\frac{1}{3}$ the height of its fin, the second about $\frac{1}{2}$. Gray, the fins usually edged with black; young with white spots on the back, which usually wholly disappear with age. Aleutian Islands to Santa Barbara, very abundant, similar in habits to the preceding, and likewise producing "Dogfish" oil. A similar species, possibly the same, *S. fernandinus* (Molina) occurs in Chile. (Named for Dr. George Suckley, a naturalist on the U. S. Pacific R. R. Survey.)

*Spinax (Acanthias) sucklii*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 196, Fort Steilacoom, Washington.
*Squalus sucklii*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 499.
*Acanthias sucklii*, GIRARD, Pacific R. R. Survey, 368, 1858.

## 38. CENTROSCYMNUS, Bocage & Capello.

*Centroscymnus*, BOCAGE & CAPELLO, Proc. Zoöl. Soc., 1864, 263, (*cœlolepis*).

Dorsal fins each with a spine, which is hidden in the skin; mouth wide, but little arched; a long, deep, straight, oblique groove on each side of mouth. Teeth of lower jaw oblique, with the point more or less directed outward. Upper teeth lanceolate, on a quadrangular base, with a single cusp. Spiracles wide, behind the eye. Gill openings narrow. (*κέντρον*, spine; *σκύμνος*, an ancient name of some shark, from *σκύμνος*, a lion's whelp.)

### 73. CENTROSCYMNUS CŒLOLEPIS, Bocage & Capello.

Labial groove prolonged forward, but separated by a broad space from that of the other side. Upper teeth very small, narrow, and lanceolate. Distance between the nostrils rather less than $\frac{1}{2}$ the length of the præoral portion of the snout. Lower angle of the pectoral rounded, not produced. Dorsal fins short, especially the first, the length of which (without the spine) is only about $\frac{1}{6}$ its distance from the second; extremity of the ventrals below the end of the second dorsal. Scales on the head and nape with striæ, the others smooth, with a depression at the base. Uniform blackish brown. (Günther.) Coast of Portugal and neighboring parts of the Atlantic, occasionally taken in deep water off Gloucester, Mass., and off the banks of Nova Scotia. (*κοῖλος*, hollow; *λεπίς*, scale.) (Eu.)

*Centroscymnus cœlolepis*, Bocage & Capello, Proc. Zoöl. Soc., 263, 1864, Portugal.
*Centrophorus cœlolepis*, Günther, Cat., viii. 423, 1870.
*Centroscymnus cœlolepis*, Jordan & Gilbert, Synopsis, 17, 1883.

## 39. ETMOPTERUS, Rafinesque.

*Etmopterus*, Rafinesque, Caratteri, etc., 14, 1810, (*aculeatus*).
*Spinax*, Cuvier, Règne Animal, Ed. i, 129, 1817, (*acanthias* and *spinax*).
*Spinax*, Müller & Henle, Plagiostomen, 86, 1838, (*spinax*).
*Acanthidium*, Lowe, Proc. Zoöl. Soc. London, 1839, 91, (*pusillum*).

Mouth little arched. Teeth of lower jaw with the point so much turned aside that the inner margin of the tooth forms the cutting edge; upper teeth erect, each with a long pointed cusp and 1 or 2 smaller ones on each side; spiracles wide. Two species, in the Atlantic. (*ἔτμαγον*, to cut; *πτερόν*, fin, the original type having frayed fins.)

### 74. ETMOPTERUS PUSILLUS, (Lowe).

Body smooth, scales very small, each with a minute tuberosity, but without spines; first dorsal fin much shorter than the second, midway between second dorsal spine and the eye; tail relatively shorter than in *E. spinax*, its length less than the space between the snout and the origin of the pectorals; color brown. (Gunther.)

The *Blake* took a single individual, believed to belong to this species, at Station CVIII, off St. Christopher, in 208 fathoms. It had previously been known only from Madeira and Cuba, and the *Travailleur* found it at the Cape Verdes at about 290 fathoms. (Goode & Bean.) (*pusillus*, weak.)

*Acanthidium pusillum*, Lowe, Proc. Zoöl. Soc. London, 1839, 91, Madeira.
*Spinax pusillus*, Günther, Cat., viii, 425, 1870.
*Spinax hillianus*, Poey, Memorias, ii, 340, 1861, Cuba.

## 40. CENTROSCYLLIUM, Müller & Henle.

*Centroscyllium*, Müller & Henle, Systematische Beschreibung der Plagiostomen, 191, 1838, (*fabricii*).

Teeth equal in both jaws, very small, straight, pointed, each with 1 or 2 smaller cusps on each side at base; mouth crescent-shaped, with a straight, oblique groove at its angle; spiracles moderate; gill openings rather narrow; dorsal fins small, each with a strong spine; the second dorsal entirely behind the ventrals. One species, in the Arctic Seas. (*κέντρον*, spine, *σκυλλίον*, *Scyllium*, an allied genus, from *σκύλλω*, to rend or tear to pieces.)

### 75. CENTROSCYLLIUM FABRICII, (Reinhardt).

Body covered with minute stellate ossification; dorsal fins short, with strong spines; second dorsal behind ventrals; color nearly black; Greenland Seas, southward in deep water; occasionally taken off Gloucester and off the Nova Scotia Banks. (Named for Otho Fabricius, a Danish naturalist, the first to study the fishes of Greenland.)

*Spinax fabricii*, Reinhardt, Dansk. Vid. Selsk. Forh., 1828, 111, xiv, Greenland.
*Centroscyllium fabricii*, Günther, Cat., viii, 425, 1870.
*Centroscyllium fabricii*, Jordan & Gilbert, Synopsis, 16, 1883.

## Family XIX. DALATIIDÆ.

### (The Scymnoid Sharks.)

Sharks with no anal fin and with 2 dorsal fins, each without spine; fins all small; gill openings small, entirely in advance of pectorals; mouth but little arched; a long, deep, straight, oblique groove on each side of it; spiracles present. Oviparous, the eggs without horny case (at least in Somniosus). Vertebræ cyclospondylous. The absence of dorsal spine chiefly distinguishes this family from the Squalidæ, of which these are somewhat degenerate allies Genera, 5; species, about 10, mostly of the North Atlantic, some of them reaching a large size. (Spinacidæ, part, Günther, Cat., viii, 425–429.)

Somniosinæ:
*a.* First dorsal much in advance of ventrals.
  *b.* Upper teeth narrow, the lower quadrate, with a horizontal edge ending in a point directed outward; body very robust, the fins very small, the dorsals about equal; skin moderately rough. Somniosus, 41.

## 41. SOMNIOSUS, Le Sueur.

*Somniosus*, Le Sueur, Jour. Ac. Nat. Sci. Phila., 1818, i, 222. (*brevipinna*=*microcephalus*).
*Leiodon*, Wood, Proc. Bost. Soc. Nat. Hist., ii, 174, 1847, (*echinatum*=*microcephalus*).
*Læmargus*, Müller & Henle, Plagiostomen, 93, 1838, (*borealis*=*microcephalus*).
*Rhinoscymnus*, Gill, Proc. Ac. Nat. Sci. Phila., 1864, 264, (*rostratus*).

Body thick and clumsy; mouth transverse, little arched, with a deep, straight groove running backward from its angle; nostrils near the extremity of the snout; jaws feeble; teeth in upper jaw small, narrow, conical; lower teeth numerous, in two or more series, the point so much turned aside that the inner margin forms a cutting edge, which is entire; spiracles moderate; no nictitating membrane; gill openings narrow; fins all very small, the ventrals between the dorsal fins; skin uniformly covered with minute tubercles. Tail short, much bent upward. Eggs large, soft, globular, without shell, dropped in the ooze on the sea bottom. Species 2, of the Northern Seas. (Latin *somniosus*, sleepy.)

### 76. SOMNIOSUS MICROCEPHALUS, (Bloch).

(SLEEPER SHARK; NURSE.)

Body robust, rapidly tapering behind; greatest depth a little more than $\frac{1}{8}$ the length; head somewhat less; mouth moderate, upper jaw with 5 rows of small sharp teeth, which are incurved and lancet-shaped; lower jaw with 2 rows of broad, quadrangular teeth, divided in their centers by a perpendicular ridge and directed outward, about 26 teeth on each side; fins small, the first dorsal about as large as the ventrals and larger than the second dorsal; pectorals short, caudal short and bluntish. L. about 25 feet. Arctic Seas south to Cape Cod, Oregon and France; a huge clumsy shark, not rare northward. An enemy to the whales, biting out large masses of flesh from their bodies. (*μικρός*, small; *κεφαλή*, head.) (EU.)

*Squalus microcephalus*, BLOCH & SCHNEIDER, Syst. Ichth., 135, 1801, Northern Seas.
*Somniosus brevipinna*, LE SUEUR, Jour. Ac. Nat. Sci. Phila., I, 122, 1818, Massachusetts.
*Scymnus brevipinna*, STORER, Fishes Mass., 235, 1867.
*Squalus borealis*, SCORESBY, Arct. Reg., I, pl. 15, figs. 3 and 4, 1820, 538, Arctic.
*Læmargus borealis*, GÜNTHER, Cat., VIII, 426, 1870.
*Squalus glacialis*, FABER, Fische Isl., 23, 1829, Iceland.
*Squalus norwegianus*, BLAINVILLE, Faun. Française, 61, 1828, Norway.
*Leiodon echinatum*, WOOD, Proc. Bost. Soc. Nat. Hist., II, 174, 1847.

## Family XX. ECHINORHINIDÆ.

(THE BRAMBLE SHARKS.)

Characters of the family included below in those of the single genus.

*a.* First dorsal opposite ventrals, both fins very small. Teeth equal in the two jaws, very oblique; skin with scattered round tubercles, like the thorns of brambles. ECHINORHINUS, 42.

### 42. ECHINORHINUS, Blainville.

*Echinorhinus*, BLAINVILLE, Bull. Sci. Philom., 1816, 121. (*spinosus*).
*Goniodus*, AGASSIZ, Poissons Fossiles, III, 183, 1836, (*spinosus*).

Two very small dorsal fins without spine, the first opposite the ventrals; no anal fin; skin with scattered, large, round tubercles, surmounted by prickles like those on a bramble, and, like them, leaving a scar when detached. Mouth crescent-shaped; a labial fold around the angle of the mouth and the end of the snout. Teeth equal in both jaws, very oblique, the point being turned outward; several strong denticulations on each side of the principal point; no nictitating membrane; spiracles small; gill openings of moderate width. A single species of the East Atlantic, straying to our coast. (*ἐχῖνος*, a hedgehog, or sea urchin; *ῥίνη*, shark.)

### 77. ECHINORHINUS SPINOSUS, (Gmelin).

Spiracles behind the eye, behind the vertical from the angle of the mouth. Teeth $\frac{22-26}{22-26}$. Dorsal fins close together. Each tubercle with a small spine in the center. Brownish violet, with or without dark spots. (Günther.) A large shark of the Atlantic coasts of Europe and Africa, in rather deep water; a stray individual taken on Cape Cod. L. 10 feet. (Eu.)

*Squalus spinosus*, GMELIN,* Syst. Nat., 1788, 1500, "the ocean."

*Echinorhinus spinosus*, Günther, Cat., VIII., 428, 1870.

*Echinorhinus spinosus*, JORDAN & GILBERT, Synopsis, 14, 1883.

*Squalus brucus*, BONNATERRE,* Tabl. Encyclop., Ichth., 11, 1788, "the ocean."

*Echinorhinus obesus*, ANDREW SMITH, Ills. Zoöl. So. Africa; Fishes, plate I, 1845, Cape of Good Hope.

## Suborder TECTOSPONDYLI.

Characters of the group given above. (See page 53.)

## Family XXI. SQUATINIDÆ.

### (THE ANGEL SHARKS.)

Ray-like sharks. Body depressed and flat, the snout obtuse, the mouth anterior; teeth conical, pointed, distant; pectoral fins very large, expanded in the plane of the body, but not adherent to the side of the head, being deeply notched at the base; ventral fins very large; dorsal fins 2, small, subequal, on the tail behind the ventrals; no anal fin; caudal small; gill openings wide, partly inferior, partly hidden by the base of the pectoral; spiracles wide, crescent-shaped, behind the eyes; nostrils on the front margin of the snout, with skinny flaps; males with small prehensile appendages; vertebræ tectospondylous. A single genus among living forms, with but one species so far as known; a small shark of singular appearance, found in most warm seas. In appearance, as in structure, this family is strictly intermediate between the sharks and the rays. Its nearest living allies are probably the DALATIIDÆ. Two or more related genera are found as fossils. (RHINIDÆ, Günther, Cat., VIII, 430.)

## 43. SQUATINA, Duméril.

### (ANGEL FISHES.)

*Squatina*, CONSTANT DUMÉRIL, Zoöl. Analyt., 102, 1806, (*angelus=squatina*).

*Rhina*, RAFINESQUE, Caratteri Alcuni Nuovi Generi, 14, 1810, (*squatina*).

*Rhina*, (KLEIN), AUGUSTE DUMÉRIL, Elasmobranches, 464, 1870, (*squatina*).

Characters of the genus included above. (*Squatina*, the ancient name, akin to the English words "skate" and "squat.")

### 78. SQUATINA SQUATINA, (Linnæus).

### (MONKFISH; ANGEL FISH; SQUATO.)

Caudal fin triangular, the lower lobe the longer; dorsals short and high; skin rough, with small stiff prickles, largest along the middle line of the back; eyes small. Ashy gray above, much blotched and speckled with olive, white below. L. 2 to 3 feet. Warm seas; common in the Mediterranean; rather scarce on our Atlantic coast from Cape Cod southward; rather common on the coast of California, especially from San Francisco to Monterey.

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*We do not know which of these names has priority, but follow usage in retaining that of Gmelin.

The East coast form has been named *Squatina dumérili*, the Pacific form *Squatina californica*, but all belong apparently to the same species. (Eu.)

*Squalus squatina*, Linnæus, x, 1758, 233, Coasts of Europe.
*Squatina lævis*, Cuvier, Règne Anim., Ed. 1, 131, 1817, after Linnæus.
*Squatina angelus*, Duméril, Zöol. Anal., 102, 1806, after Linnæus.
*Squatina dumérili*, Le Sueur, Jour. Ac. Nat. Sci. Phila., 1, 225, 1818, probably Florida.
*Squatina californica*, Ayres, Proc. Cal. Ac. Sci., 1859, 29, San Francisco.
*Rhina squatina*, Günther, Cat., viii, 430, 1870.
*Squatina angelus*, Jordan & Gilbert, Synopsis, 35, 1883.
*Squatina angelus*, Cuvier, Règne Animal, Ed. ii, 369, 1829.
*Squatina vulgaris*, Risso, Ichth. Nice, 45, 1810, Nice.
*Squatina fimbriata*, Müller & Henle, Plagiostomen, 101 and 192, 1838, Mediterranean Sea.
*Squatina oculata*, Bonaparte, Fauna. Ital., Pesc., xxviii, 1840, Italy.
*Squatina japonica*, Bleeker, Act. Soc. Sci., Indo-Neerl, iii, Japan.
*Squatina lewis*, Couch, Trans. Linn. Soc., xiv. 90, 1825, Cornwall.

## Order G. BATOIDEI.

### (The Rays.)

Gill openings inferior, slit-like, 5 in number; spiracles present; no anal fin; dorsal fins, if present, inserted on the tail; body typically disk-like, broad and flat, the margin of the disk being formed by the expanded pectorals; tail comparatively slender, the caudal fin small or wanting. Vertebræ cyclospondylous. With the exception of the Rajidæ, most or all of the rays are ovoviviparous. (Suborder Batoidei, Günther, Cat., viii, 434–498.) (*βάτος*, a ray, *εἶδος*, likeness.)

*a.* Sarcura (*τάρξ*, flesh; *οὐρά*, tail). Tail comparatively thick, with 2 dorsals and a caudal fin; no serrated caudal spine.
  *b.* Snout saw-like, much produced, flat, armed with strong teeth on each side, set at right angles to its axis; body somewhat shark-like, the disk gradually passing into the tail. Pristidæ, xxii.
  *bb.* Snout not saw-like.
    *c.* Electric organs absent; skin not perfectly smooth.
      *d.* Species ovoviviparous, the young developed within the body of the parent. Disk passing gradually into the long stout tail; pectorals not extending to the snout. Rhinobatidæ, xxiii.
      *dd.* Species oviparous; the eggs deposited in wheelbarrow-shaped leathery egg-cases; disk abruptly contracted at base of the tail; pectorals extending to the snout. Rajidæ, xxiv.
    *cc.* Electric organs present; a structure composed of honeycomb-like tubes between pectoral fins and head; skin perfectly smooth. Narcobatidæ, xxv.
*aa.* Masticura (*μάστιξ*, whip. *οὐρά*, tail). Tail comparatively slender, the dorsal fin single or wanting; the back of the tail usually with a serrated spine.
  *e.* Pectoral fins uninterrupted, confluent around the snout; teeth small. Dasyatidæ, xxvi.
  *ee.* Pectoral fins interrupted, one portion forming detached appendages on the snout ("cephalic fins").
    *f.* Teeth very large, flat, tessellated, few in number. Myliobatidæ, xxvii.
    *ff.* Teeth numerous, very small, flat or tubercular; size enormous; cephalic fins conspicuous, resembling horns. Mantidæ, xxviii.

The rays form a highly specialized group of Selachians, of which the typical forms present an appearance quite unlike that of the average shark. The intergradations between the two groups are, however, extremely perfect, the families of Squatinidæ and Pristiophoridæ, ray-like sharks, closely approaching the PRISTIDÆ and RHINOBATIDÆ. As above noticed, the *Batoidei* seem to be descended from the *Cyclospondylous* sharks.

## Suborder SARCURA.

### (THE THICK-TAILED RAYS.)

### Family XXII. PRISTIDÆ.

(THE SAWFISHES.)

Body elongate, depressed; pectoral fins moderate, the front margin quite free, not extending to the head; snout produced into a very long, thin, flat blade, which is armed with a series of strong, tooth-like processes placed in sockets along each edge; teeth in jaws minute, obtuse; gill openings moderate, inferior; spiracles wide, behind the eye; nostrils inferior; no tentacles; no nictitating membrane; dorsal fins large, without spine, the first nearly opposite the ventrals. Caudal well developed, bent upward; a fold along each side of tail. A single genus, with 5 or more species, inhabiting warm seas on sandy shores, sometimes ascending rivers. A family of sharks, PRISTIOPHORIDÆ, similarly armed with a "saw," occurs in the Pacific Ocean. (PRISTIDÆ, Günther, VIII, 436–439.)

### 44. PRISTIS, Latham.

*Pristis*, LATHAM, Trans. Linn. Soc., II, 276, 1794, (*pristis*).
*Pristobatus*, BLAINVILLE, Journ. Phys., 1816, 262, (*antiquorum=pristis*).
*Myriosteon*, GRAY, Proc. Zoöl. Soc., 1864, (*higginsi*, based on a fragment of a rostral process).

Characters of the genus included above. (*πρίστης*, the ancient name, meaning one who saws.)

- *a.* Rostral teeth in 18 to 20 pairs; first dorsal chiefly before ventrals; caudal with a small lower lobe. PERROTTETI, 79.
- *aa.* Rostral teeth in 24 to 32 pairs; first dorsal opposite ventrals; caudal without lower lobe. PECTINATUS, 80.

### 79. PRISTIS PERROTTETI, Valenciennes.

First dorsal fin chiefly in advance of ventrals; second dorsal much smaller than first; caudal with a small lower lobe; root of pectoral before first gill opening, its outer angle a right angle. Saw with 18 to 20 pairs of teeth, well separated and not trenchant behind. (Günther.) Tropical seas, north to Mazatlan on the Pacific coast; also said to occur in the West Indies; not so common as the next. It may be that our Pacific species is distinct from the true *perrotteti*, first obtained in Africa. (Named for M. Perrottet, a French naturalist, who obtained the types.)

*Pristis perrotteti*, VALENCIENNES MS., MÜLLER & HENLE, Plagiostomen, 108, 1838, Senegal River; GÜNTHER, Cat., VIII, 436, 1870.

### 80. PRISTIS PECTINATUS, Latham.

(COMMON SAWFISH; PEZ SIERRA.)

First dorsal over ventrals; second dorsal scarcely smaller than first; no lower caudal lobe. Saw with 24 to 32 pairs of teeth, the posterior farther apart than the anterior. L. 10 to 20 feet. Tropical seas; north to West Indies and Florida; abundant in the Gulf of Mexico; ascending the lower Mississippi. (*pectinatus*, comb-toothed.)

*Pristis pectinatus*, LATHAM, Trans. Linn. Soc., II, 278, 1794, "in the ocean."
*Pristis granulosa*, BLOCH & SCHNEIDER, Syst. Ichthyol., 352, 1801, (after Parra), Havana.
*Pristis pectinatus*, GÜNTHER, Cat., VIII, 437, 1870.
*Pristis pectinatus*, JORDAN & GILBERT, Synopsis, 875, 1883.
*Pristis mississippiensis*, RAFINESQUE, Ich. Oh., 80, 1820, lower Mississippi.
*Pristis megalodon*, DUMÉRIL, Elasmobranches, 476, pl. 9, fig. 4, 1870, Cayenne.
*Pristis acutirostris*, DUMÉRIL, *l. c.*, 479, 1870, Martinique.
*Pristis occa*, DUMÉRIL, *l. c.*, 479, 1870, locality unknown.

## Family XXIII. RHINOBATIDÆ.

### (THE GUITAR FISHES.)

Shark-like rays. Trunk gradually passing into the long and strong tail, which is provided with 2 well-developed dorsal fins, a caudal fin and a conspicuous dermal fold on each side; disk not very broad, the rayed portion of the pectoral fins not being continued to the snout; no conspicuous spines, the skin being nearly smooth; no electric organs. Genera about 5; species about 20; inhabiting warm seas, distinguished from the RAJIDÆ chiefly by the fact that the eggs are hatched within the body. The typical species are also much more elongated in form. (RHINOBATIDÆ, Günther, Cat., VIII, 440–448.)

- *a.* First dorsal much behind the ventrals; anterior nasal valves not confluent.
  - *b.* Disk subtriangular or rhombic; the snout more or less produced; skin covered with fine shagreen, usually with somewhat larger spines on the back of tail. RHINOBATUS, 45.
  - *bb.* Disk rhombic, the snout less produced; nasal valves dilated, extending on the space between nostrils; body covered with irregular tubercles and prickles instead of shagreen. ZAPTERYX, 46.
  - *bbb.* Disk broad, rounded in front; nasal valves broad; body covered with shagreen, with stout spines on back and tail; labial fold well developed. PLATYRHINOIDIS, 47.

## 45. RHINOBATUS, Bloch & Schneider.

### (GUITAR FISHES.)

*Rhinobatus*, BLOCH & SCHNEIDER, Syst. Ichth., 353, 1801, (*rhinobatus*).
*Leiobatus*, RAFINESQUE, Caratteri, 16, 1810, (*panduratus*).
*Syrrhina*, MÜLLER & HENLE, Plagiostomen, 113, 1838, (*columnæ* = *panduratus*).
*Glaucostegus*, BONAPARTE, Catologo Metodico, 14, 1846, (*rhinobatus*).

Body depressed, gradually passing into the tail. Cranial cartilage produced into a long rostral process, the space between the process and the pectoral fin being filled by membrane; spiracles wide, behind the eye; nostrils oblique, wide; anterior valves not confluent; teeth obtuse, with an indistinct transverse ridge. Dorsal fins without spine; both far behind the ventral fins; caudal fin without lower lobe. Claspers slender and pointed. Species numerous in warm seas, varying considerably as to the form of the snout; those with the snout shortened and the nasal valves broader constituting the subgenus *Leiobatus*, or *Syrrhina*. (*ῥίνη*, a shark; *βάτος*, a skate.)

RHINOBATUS:

- *a.* Nasal valves not extending on the space between the nostrils; disk subtriangular, the snout slender and pointed.
  - *b.* Spiracle with two folds.
    - *c.* Skin above everywhere closely freckled with whitish; ridges of rostral cartilage close together, narrowly separated at base. LENTIGINOSUS, 81.

*cc.* Skin above plain olivaceous, or with obscure large whitish blotches.
  *d.* Ridges of rostral cartilage separate throughout.
    *e.* Disk above marked with faint, round slate-colored spots as large as eye; snout 2½ in length of disk, not very sharp at tip. GLAUCOSTIGMA, 82.
    *ee.* Disk without traces of pale spots above; snout rather longer, acute at tip. LEUCORHYNCHUS, 83.
  *dd.* Ridges of rostral cartilage confluent about ½ the length; snout rounded at tip. PRODUCTUS, 84.
  *ddd.* Ridges of rostral cartilage united more than ½ their length; snout produced, narrow.
    *f.* Groove between rostral cartilages moderate; upper surface with some large, faint whitish spots; shoulders with 2 patches of spines. PERCELLENS, 85.
    *ff.* Groove between rostral cartilages very short and small. SPINOSUS, 86.
*bb.* Spiracle with a single fold; snout blunt, rounded. PLANICEPS, 87.

### 81. RHINOBATUS LENTIGINOSUS, Garman.

Snout long and narrow, its ridges close together throughout. Eyes large, twice as large as spiracles. Interorbital space narrow, concave, as wide as nostrils or the interspace between them. Distance between outer angles of nostrils more than ½ the snout. Mouth straight, its width not quite the interorbital space. Dorsal and preocular spines very small; five larger spines on tip of snout; supraocular and scapular spines obsolete. L. 2 feet. Grayish, densely freckled with small paler spots, uniform below. Width 3 in length; tail about 2; snout to the mouth 5¾. Charleston southward, not rare on the Florida coast. (*lentiginosus*, freckled.)

*Rhinobatus lentiginosus*, GARMAN, Bull. Mus. Comp. Zoöl., 1880, 168, Coast of Florida.
*Rhinobatus lentiginosus*, JORDAN & GILBERT, Synopsis, 65, 1883.

### 82. RHINOBATUS GLAUCOSTIGMA, Jordan & Gilbert.

(GUITARRO.)

Disk long and narrow, the snout produced but not acute at tip, its length 2½ in disk; interorbital width 3½ in snout; spiracle large, with 2 folds; rostral ridges moderately separated, slowly convergent anteriorly, but not united; snout in female without fimbriate appendage; vent somewhat nearer snout than base of caudal; dorsal fins similar; skin everywhere rough with fine shagreen; no spines on snout; superciliary spines very small; 1 or 2 spines on shoulder; a series of low, bluntish spines along the middle of back, becoming larger and farther apart behind. Color light gray, with the usual translucent area on sides of snout. Disk with numerous round, clear slate-colored spots as large as eye, symmetrically arranged; a blackish blotch below snout. L. 2½ feet. Gulf of California, locally abundant; close to the next, but well distinguished by its color, which does not fade in spirits. (*γλαυκός*, hoary blue; *στίγμα*, spot.)

*Rhinobatus glaucostigma*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1883, 210, Mazatlan. (Type, Nos. 28205; 28206; 29547; 29602.)

### 83. RHINOBATUS LEUCORHYNCHUS, Günther.

Disk rather long, the snout acute at tip; rostral ridges separate for their whole length, converging toward tip of snout; eye moderate;

interorbital width 3½ in snout; spiracle with 2 folds. Body covered with uniform shagreen; small spines on orbital ridges; a row of small spines on back, a pair on each shoulder; dorsal fins similar. Light olivaceous brown, unspotted, the usual pale areas on snout. Panama and vicinity, not rare. (λευκός, white; ῥύγχος, snout.)

*Rhinobatus leucorhynchus*, Günther, Proc. Zoöl. Soc. Lond., 604, 1866, Panama.
*Rhinobatus leucorhynchus*, Garman, Proc. U. S. Nat. Mus., 1880, 517.

### 84. RHINOBATUS PRODUCTUS, Ayres.

(Guitar Fish.)

Snout rather long, rounded at the tip; rostral ridges armed with small spines above and confluent about ½ their length; spiracle with 2 folds; moderate, hooked spines along middle line of back; smaller spines on shoulder and around eye; females with a small digitate flap, free behind, above tip of snout. Color dull grayish, unspotted, a black blotch below snout. San Francisco to San Diego, common southward. (*productus*, produced.)

*Rhinobatus productus*, Ayres MS., Girard, Proc. Ac. Nat. Sci. Phila., 1854, 196, Monterey.
*Rhinobatus productus*, Garman, Proc. U. S. Nat. Mus., 1880, 517.
*Rhinobatus productus*, Jordan & Gilbert, Synopsis, 876, 1883.

### 85. RHINOBATUS PERCELLENS, (Walbaum).

(Fiddler Fish; Puraque.)

Rostral cartilages very narrow, confluent more than ½ their length; snout long and narrow, about 4½ times interorbital width; eye moderate; spiracles with 2 tubercles on hinder margin. Mouth nearly straight. Skin covered above and below with shagreen; a vertebral series of small spines; a row of several near the middle of shoulder girdle on each side, none on snout. Olivaceous, with a few round white spots on middle of disk; snout with translucent spaces; adult sometimes unspotted. West Indies to southern Brazil, generally common southward, north to Jamaica (Cockerell). (*percellens*, smiting.)

*Raja percellens*, Walbaum, Artedi Piscium, 525, 1792 (after Puraque of Marcgrave, 151).
*Rhinobatus electricus*, Bloch & Schneider, Syst. Ichth., 356, 1801, Brazil, based on Puraque of Marcgrave.
*Rhinobatus undulatus*, Ölfers, Torpedo, 22, 1831, Brazil.
*Rhinobatus undulatus*, Günther, Cat., viii, 444, 1870.
*Rhinobatus glaucostictus*, Ölfers, *l. c.*, 1831, Brazil.
*Rhinobatus marcgravii*, Henle, Ueber Narcine, 34, 1834, Brazil.

### 86. RHINOBATUS SPINOSUS, Günther.

Snout much produced, the rostral ridges very narrow, largely confluent, with a very small, short groove at base, their whole length armed with spines; mouth nearly straight; compressed spines dilated at base along median line of back, on shoulder, and above eye and spiracle. Color plain. Mexico (probably the east coast). (Günther.) (*spinosus*, spiny.)

*Rhinobatus spinosus*, Günther, Cat., viii, 518, 1870, Mexico; not recorded by any other author.

### 87. RHINOBATUS PLANICEPS, Garman.

Disk rhombic, about 1½ times as long as wide; head broad, flat; rostral cartilages moderate, dilated at tip, with the ridges close together anteriorly; snout rounded; spiracle with a single fold. Back and tail with compressed, hooked spines; 2 patches of spines on each shoulder and a series above eye. Color brownish; young with some white spots on back. Coast of Peru and Galapagos Islands. (Garman.) (*planus*, flat; *-ceps*, for *caput*, head.)

*Rhinobatus planiceps*, GARMAN, Bull. Mus. Comp. Zoöl., 168, 1880, Peru; Galapagos.

## 46. ZAPTERYX, Jordan & Gilbert.

*Zapteryx*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1880, 53, (*exasperata*).

This genus is close to the section *Leiobatus* (*Syrrhina*) of *Rhinobatus*, from which it differs mainly in having the upper parts covered with coarse, irregular stellated prickles, instead of a uniform shagreen. The snout is of moderate length and the nasal valve broader, extending on the space between the nostrils. Two species known. (*ζα-*, an intensive particle; *πτέρυξ*, fin, the vertical fins being larger than in *Raja*, and the ventrals not emarginate.)

*a.* Disk slightly longer than broad; no yellow spots above. EXASPERATUS, 88.
*aa.* Disk slightly broader than long; back with yellow spots above, surrounded with black. XYSTER, 89.

### 88. ZAPTERYX EXASPERATUS, (Jordan & Gilbert).

Disk rhombic, rather longer than broad. Snout prominent, but bluntish at tip, anterior margin of pectorals forming less than a right angle; eyes rather large; anterior nasal valve prolonged to the internal angle of the nostrils; rostral ridges parallel, separate their whole length. Tail stout, depressed, with a narrow lateral fold. Upper surface entirely covered with stout, close-set, stellated prickles of different sizes, largest on the bases of the pectorals and smallest on the outer edges of the fins, those on the tip of snout and anterior edge of the pectorals not enlarged; stout, bluntish, slightly recurved spines present as follows: One at the upper anterior angle of the eye and 2 behind it; 1 large one at the middle of the shoulders, in front of which are 2 others; 2 series on the shoulders outside the median line, the inner of 2, the outer of 2 to 4; a series of about a dozen on the median line of the back and tail; no lateral series on the tail. Under side covered with shagreen, made of triangular depressible asperities; region from the nostrils to the shoulder girdle smooth, except the lower lip; a few other small naked areas below. Upper lip developed. Teeth $\frac{3}{2}\frac{2}{6}$. Color brown, mottled and barred with blackish; the markings mostly in the form of transverse bands; fore part of head blackish; a black blotch on hinder part of pectorals below. Tail rather shorter than disk. First dorsal not far behind ventrals, nearer hind part of root of ventrals than front of second dorsal. Snout ⅕ the length of disk, twice the interorbital space. San Diego Bay; locally abundant; only male specimens known. L. 2½ feet. (*exasperatus*, made rough.)

*Platyrhina exasperata*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1880, 32, San Diego. (Type, No. 35050.)
*Zapteryx exasperatus*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1880, 53.
*Trygonorhina alveata*, GARMAN, Bull. Mus. Comp. Zoöl., 1880, 169, San Diego.
*Syrrhina exasperata*, GARMAN, Proc. U. S. Nat. Mus., 1880, 521.
*Rhinobatus exasperatus*, JORDAN & GILBERT, Synopsis, 63, 1883.

### 89. ZAPTERYX XYSTER, Jordan & Evermann, new species.

Disk somewhat broader than long, its length slightly greater than that of tail. Coloration similar to that of *Z. exasperatus*, including the large black blotch on posterior angle of pectoral below; upper side of disk with several round yellowish spots as large as pupil, each spot ocellated with blackish; a very distinct spot on each side of shoulder; a second on pectoral fin near posterior angle; a third midway between latter and median line of back; several fainter spots on back anteriorly. Spines and prickles above as in *Z. exasperatus*, but entire lower surface covered with fine shagreen, this perhaps a sexual character. L. 22 inches. Two female specimens (Museum Yale University), collected by Prof. Frank H. Bradley at Panama in 1866. (*ξυστήρ*, a scraper.)

*Syrrhina exasperata*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 621.

## 47. PLATYRHINOIDIS, Garman.

*Platyrhinoidis*, GARMAN, Proc. U. S. Nat. Mus., 1880, 522, (*triseriata*).

Disk broad, flat, and rounded, the tail moderate, depressed; dorsals posterior; middle line of back and edges of pectorals and tail with stout spines; skin covered with fine shagreen as in *Rhinobatus;* labial fold well developed; nasal valves not reaching the mouth, the posterior lobe rudimentary. One species, with the general form of a ray and the color and appearance of *Rhinobatus*, like which genus, it is viviparous. (*Platyrhina*, or *Discobatus*, an Asiatic genus of *Rajidæ*, which species it resembles in form; *εἶδος*, like; *Platyrhina* from *πλατύς*, broad; *ῥίν*, snout.)

### 90. PLATYRHINOIDIS TRISERIATUS, (Jordan & Gilbert).

Disk broad, ovate, broader than long; snout very bluntly rounded, not projecting; the angle formed by the pectorals anteriorly very obtuse; anterior outline of the pectorals slightly convex, not undulated. Tail very stout, much longer than the disk, its edges with a broad fold, broader than in *Z. exasperatus;* pectoral fins extending almost to the tip of the snout; rostral ridges wide apart, strongly converging forward, inclosing a triangular area. Eyes small, wide apart; the broad spiracles close behind them. Caudal fin well developed above and below; dorsals similar, their posterior free margins very convex; first dorsal well backward, its origin nearer root of caudal than ventrals. Mouth broad, its width nearly equal to its distance from tip of snout, a deep crease passing around it behind, in front of which the lower lip has 3 folds of skin; upper lip not developed, a fold of skin passing from the angle of the mouth on either side to the inner angle of the nostrils, thence straight across, inclosing a depressed, trapezoidal ⏢ shaped area, bounded below by the curved outline of the upper jaw: in this are 3 cross folds of skin.

Teeth $\frac{60}{66}$. Gill openings narrow. Skin everywhere, above and below, covered with fine shagreen, the prickles coarser on the anterior outer margin of the pectorals (♂), where are 2 or 3 rows of retrorse spines; 4 strong spines on the tip of the snout, forming a rhombic figure; 4 or 5 spines around each eye; a long series of very strong spines along the median line of back and tail, and a series of similar ones on each side of the tail; a single strong spine on the outer edge of the shoulder girdle and 2 between this and the median series. Breadth of disk $\frac{1}{10}$ more than its length; tail usually $\frac{1}{2}$ longer than disk; snout $\frac{2}{9}$ of length of disk, not $\frac{1}{2}$ longer than width of interorbital area. Color light olive brown, without distinct markings. L. 2 feet. Coast of California from Point Concepcion southward; abundant. (*triseriatus*, 3-rowed, from the spines on the tail.)

*Platyrhina triseriata*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1880, 36, **Santa Barbara, California.** (Type, No. 26893.)

*Rhinobatus triseriatus*, JORDAN & GILBERT, Synopsis, 64, 1883.

*Platyrhinoidis triseriatus*, GARMAN, Proc. U. S. Nat. Mus., 1880, 522.

## Family XXIV. RAJIDÆ.

### (THE SKATES.)

Disk broad, rhombic, the skin more or less roughened with spines or prickles; tail stout, rather long, with a longitudinal fold on each side; usually 2 dorsal fins and sometimes a caudal fin present, all on the tail; pectoral fins extending to the snout; ventrals large; no serrated spine on the tail; no electric organs. Oviparous, the eggs being laid in large leathery egg cases, 4-angled, with 2 long tubular "horns" at each end. Genera 4 or more; species 40, most of them belonging to the genus *Raja*. Found in all cool seas, some of them in deep water. (RAJIDÆ, Günther, VIII, 455–471.)

*a.* Caudal fin rudimentary or absent; pectorals not confluent around the snout; ventrals deeply notched. RAJA, 48.

### 48. RAJA, (Artedi) Linnæus.

*Raja* (ARTEDI) LINNÆUS, Syst. Nat., Ed. x, 1758, 231, (*batis*).

*Dipturus*, RAFINESQUE, Caratteri, 16, 1810, (*batis*).

*Platopterus*, RAFINESQUE, Analyse de la Nature, 93, 1815, (*batis*).

*Dasybatus*, BLAINVILLE, Journ. Phys., 1816, 260 (*communis*).

*Propterygia*, OTTO, Nova acta Acad. Cæs. Leop. Carol. Nat. Curios., 1824, 111, (*hyposticta*; monstrous example, with fins not adnate to head).

*Læviraja*, BONAPARTE, Fauna Italica, XXV, 130, 1839, (*oxyrhynchus*).

*Uraptera*, MÜLLER & HENLE, Plagiostomen, 155, 1838, (*agassizi*); (species without caudal fin.)

*Batis*, BONAPARTE, Cat. Metod., 12, 1846, *radula*, no description.

*Malacorhinus*, GARMAN, Bull. Mus. Comp. Zool., XI, 236, 1881, (*plutonia*); (species with imperfect rostral cartilage; probably recognizable as a valid genus, when the species are better known.)

*Raia*, various authors, change of spelling.

This genus, as here understood, comprises all those *Rajidæ* which have the pectoral fins not continued around the snout, the ventrals deeply notched, and the caudal fin little developed or wanting. The tail is very distinct from the disk, and is provided with 2 rayed dorsal fins. The skin of the body is usually more or less spinous; the dentition differs in the two sexes, and the male is usually provided with a differentiated patch of spines on each pectoral. Species numerous, mostly of the Northern seas. They are, on the whole, not very well known, and an analytical table which would show their natural affinities can not be made out in the present condition of our knowledge. There is considerable variety within the genus, but the natural subgenera are yet to be defined. Thus far all attempts at natural subdivision have resulted in failure. We are, therefore, forced to make a primary division on the unnatural character of the geographical distribution of the species. The synonymy of some species is still uncertain. The best account of the eastern species is that given by Mr. Garman in Proc. Bost. Soc. Nat. Hist., 1874, 170, *et seq.* Of this we have made large use in the following analysis. (*raja*, or *raia*, a ray, or skate.)

I. Atlantic species.
*a.* Middle line of back and tail behind shoulders unarmed in the adult, with a row of spines in the young; outline of disk before spiracles obtuse, without acute angle at tip of snout; species with round dark spots.
*b.* Teeth in about 50 series in each jaw; size small. ERINACEA, 91.
*bb.* Teeth in about 90 series in each jaw; size large; usually a pectoral ocellus. OCELLATA, 92.
*aa.* Middle line of back with a row of spines at all ages.
*c.* Tip of snout rounded, very blunt, without marked angle. Skin very rough; color variegated. FYLLÆ, 93.
*cc.* Tip of snout with a more or less marked angle.
*d.* Angle at tip of snout short, obtuse; teeth in 30 to 50 series.
*e.* Body and tail armed with large bucklers, each with a radiated or stellate base. RADIATA, 94.
*ee.* Body and tail armed with small, close-set, stellate spines; color dark brown with irregular markings. PLUTONIA, 95.
*eee.* Body and tail smooth or with small asperities. Larger spines on orbital region, back and tail; brownish, with lighter and darker spots.
*f.* Disk a little longer than broad. ACKLEYI, 96.
*ff.* Disk a little broader than long. ORNATA, 97.
*dd.* Angle at tip of snout acute, moderately long.
*g.* Spines on skin above scarcely stellate; teeth in 50 rows; color brown with darker markings. EGLANTERIA, 98.
*gg.* Spines on skin above small, their base stellate; teeth in about 40 rows; color brown, sometimes with 1 or 2 paler spots above. SENTA, 99.
*ddd.* Angle at tip of snout much produced, blunt at tip; teeth in 30 rows.
*h.* Skin nearly smooth, its spines few and small; color brownish, with paler spots. LÆVIS, 100.
II. Pacific species; median line of tail always with stronger spines.
*i.* Snout acute or acuminate, more or less projecting beyond the disk, the rostral cartilage well developed.
*j.* Snout very long acuminate; usually no spines on median line of back in front of ventrals; interorbital space little concave.
*k.* Snout tapering to a point; skin almost everywhere prickly above; color nearly plain brown. RHINA, 101.
*kk.* Snout long, but bluntish at the tip; skin minutely prickly above, smoother than in preceding; 1 or 2 spines at center of back; color brown, with large rounded white spots above. BINOCULATA, 102.
*jj.* Snout of moderate length, rather sharp, but shortish; color brownish; usually with 2 faint ocelli; interorbital space deeply concave; prickles on body rather small.

*l.* Eye with few or no spines below it; disk $\frac{1}{10}$ broader than long.
INORNATA, 103.
*ll.* Eye with 4 rows of spines below it; disk $\frac{1}{3}$ broader than long.
EQUATORIALIS, 104.
*ii.* Snout bluntish, its tip little if any projecting; most of upper surface rough with prickles; lower surface nearly or quite smooth; nasal cartilage weak.
*m.* Color olive brown; the spots, if any, pale; interorbital width $3\frac{1}{2}$ in snout.
PARMIFERA, 105.
*mm.* Color dark brown or blackish; whole upper surface rough with stellate prickles.
*n.* Shoulder girdle with spines.
*o.* Orbital rim with a row of stout prickles; brown, much variegated with black spots and bars, some of the spots ocellate.
STELLULATA, 106.
*oo.* Orbital rim without spines; prickles fine; size, very large.
ALEUTICA, 107.
*nn.* Shoulder girdle without spines; color dusky, nearly plain.
TRACHURA, 108.
*iii.* Snout soft, bluntish; disk above and below, with close-set, velvety prickles.
ABYSSICOLA, 109.

### 91. RAJA ERINACEA, Mitchill.

(COMMON SKATE; LITTLE SKATE; TOBACCO BOX.)

Form rhomboid, with all the angles rounded; spines largest on the anterior extensions of the pectorals, where they are close set, strong, laterally compressed, and hooked backward; smaller ones are scattered over the head above the spiracles, above and in front of the eyes, and on the back, the median line of which is comparatively smooth, without larger median series, except in the young; a triangular patch on the shoulder girdle; inner posterior angles of the pectorals nearly smooth; in the males near the exterior angles of the pectorals are 2 rows of large erectile hooks, pointing backward. Females with groups of small scales on each side of the vent; teeth small, the middle ones sharp in the males; all blunt in the females; jaws much curved; each side of tail with a dermal fold; caudal fins rough, not separate to the base. Color light brown, with small round spots of dark brown ; no pectoral ocelli; females larger than the males. L. 1 to 2 feet. The smallest and commonest of our skates; abundant on our coast, from Virginia northward to Maine. (*erinaceus*, like a hedgehog.)

*Raia erinacea*, MITCHILL, Am. Jour. Sci. Arts, XI, 290, 1825, New York; GARMAN, *l. c.*, 176; JORDAN & GILBERT, Synopsis, 41, 1883.
*Raia eglanteria*, GÜNTHER, Cat., VIII, 462, 1870, not of Lacépède.

### 92. RAJA OCELLATA, Mitchill.

(BIG SKATE.)

General form and appearance of the preceding but much larger; the arrangement of spines similar, except that additional rows of spines are present down the back and along the sides of the tail; caudal fin not separate, rough with small spines; jaws curved. Color light brown, with rounded dark spots; a translucent space on each side of the snout; near the posterior angle of the pectoral there is usually (but not always) a large white ocellus, with a dark spot in the center and a darker border;

2 smaller similar spots often present. (Garman.) Coast of New York, Massachusetts, and northward. Size very much larger than in *R. erinacea*, reaching a length of nearly 3 feet. The egg cases are more than twice as large as those of the smaller species. (*ocellatus*, with eye-like spots.)

*Raia ocellata*, MITCHILL, Trans. Lit. Phil. Soc., I, 477, 1815, New York; GARMAN, *l. c.*, 177; JORDAN & GILBERT, Synopsis, 40, 1883.

### 93. RAJA FYLLÆ, Lütken.

Disk rather broader than long, broadly rounded anteriorly; the tip of the snout very blunt and scarcely projecting; a row of strong backward-hooked spines along median line of back and tail; 2 similar spines on each shoulder and 4 or 5 over each eye; skin very rough with close set spinules, which are coarser than in most species; sides of tail very rough; tail longer than rest of body. Brown, with numerous rounded blackish blotches on disk, tail, and fins. Davis Straits, Greenland, in 80 fathoms. Known from a young example about 8 inches long. (Lütken.) (*Fylla*, name of the Danish cruiser by which the type was taken.)

*Raja fyllæ*, LÜTKEN, Vid. Medd. Naturh. Foren. Kjöbenh., 1887, 1, pl. 1, Davis Straits.

### 94. RAJA RADIATA, Donovan.

Besides the spines on the pectorals, head, back, and tail common to most species, this species is marked by the presence of large spinous plates or bucklers; these are large, strong spines, with broad, stellate or shield-like bases arranged as follows: 1 or 2 in front of each eye; 1 on each side between the eye and the spiracle; a pair on the shoulder, the smaller in front; and 14 or more forming a dorsal row, beginning just back of the head and extending to the caudal; an irregular row of spines on each side of the tail, separated from the membrane by a band of shagreen; males with 2 or more rows of claw-like spines on the pectorals. Teeth with a long, sharp point rising from the middle and hooking backward in the male, bluntish in the female; females larger than the males and more spinous. (Garman.) Size medium. L. 1½ to 2 feet. North Atlantic; found both in America and Europe, not common on our coast. (*radiatus*, radiated.) (EU.)

*Raia radiata*, DONOVAN, Hist. Brit. Fish., v, pl. 114, 1820, Great Britain; GÜNTHER, Cat., VIII, 460, 1870; GARMAN, *l. c.*, 177; JORDAN & GILBERT, Synopsis, 41, 1883.
*Raia americana*, DE KAY, N. Y. Fauna: Fishes, 368, 1842, Staten Island.

### 95. RAJA PLUTONIA, Garman.

Disk broader than long, subquadrangular, rounded in front; snout a very blunt angle; rostral cartilage short, imperfect; tail ½ longer than disk; width of mouth ½ its distance from snout; teeth in 32 series. Eyes large, their length more than interorbital width. Back and tail covered with small, close-set, stellate spines, the points slender, compressed, directed backward, a close series of large spines along median line of back and tail; a supraorbital row, and a single spine on each side of back of head; about 5 on each side of shoulder girdle, in front of which are 1 or 2 more; 2 series on each side of tail; smooth below. Color brown, the adults purplish, with irregular transverse series of ill-defined, often confluent brown spots, besides some white spots; tail with white and dark bands; dorsals dark, lower surface white. Deep water off South Carolina. (Garman.) (*plutonius*, dusky; from Pluto.)

*Raja plutonia*, GARMAN, Bull. Mus. Comp. Zoöl., XI, 236, 1881, off South Carolina; JORDAN & GILBERT, Synopsis, 878, 1883.

### 96. RAJA ACKLEYI, Garman.

Disk, including the ventrals, rhombic, longer than wide; anterior margins sinuous, posterior outline convex; tail moderate, depressed, with a narrow cutaneous fold on each side; angle formed by snout less than right. Rostral cartilage rather slender. Mouth moderate, much curved, width 1⅔ in distance from end of snout. Teeth small, cusps sharp, in 42 rows on the upper jaw (male adult). Eyes moderate; interorbital space narrow, deeply concave, its width 3 times in the distance from the end of the snout to the eye. Spiracles smaller than the eye. Ventrals medium. Dorsals small, separated by a space with tubercles; a vertebral series of small tubercles on back and tail; 2 lateral series on each side of tail; a series on each orbital ridge; a group of several above the end of the rostral cartilage; a group on each pectoral opposite eye and spiracle; a group of retractile spines opposite the shoulder near the outer angle of the pectoral; the disk otherwise smooth above; lower side of snout with fine, sharp scales or shagreen. Differing from *R. eglanteria*, which it resembles in shape, in a somewhat shorter snout and in coloration. Disk, including ventrals, 9.5 inches; width 9; tail from vent 9.6; total length 16.25 inches. Light yellowish brown, sprinkled with small spots of brown intermixed with others of white; on base of each pectoral a little behind the shoulder girdle, a transversely oblong spot of brown, ½ inch in diameter, surrounded by a ring of small spots forming a sort of rosette. Yucatan Banks, in deep water. (Garman.) (Named for Lieut. Seth N. Ackley, of the "Blake.")

*Raja ackleyi*, GARMAN, Bull. Mus. Comp. Zoöl., XI, 235, 1881, Yucatan Banks.

### 97. RAJA ORNATA, Garman.

Disk little broader than long, the anterior margins convex; tip of snout obtuse; snout not produced; width of mouth ¾ its distance from tip of snout; teeth in 44 series; entire upper surface rough with small asperities; a median series of spines on back and tail, a lateral series on each side of this on back and 2 on tail, a series on each orbital ridge; a single spine on forehead between eyes, several above tip of snout; a group on hinder angle of pectoral and on its front; lower surface smooth. Tail a little longer than disk Light brownish, freckled with paler, marked with a few groups of small darker spots; several spots on the tail; one at base of each dorsal. Deep water off South Carolina and Florida. Perhaps a variety of the preceding. (Garman.) (*ornatus*, adorned.)

*Raja ornata*, GARMAN, Bull. Mus. Comp. Zoöl., XI, 235, 1881; off South Carolina, and Alligator Key, Florida; JORDAN & GILBERT, Synopsis, 877, 1883.

### 98. RAJA EGLANTERIA, Bosc.

Prickles comparatively small and very sharp, most numerous on the anterior portion of the pectoral, over the head, on the snout, on the middle of the back, and on the tail between the rows of larger ones; enlarged spines present around the eyes and spiracles, on the middle of the snout, in a median row along the back, and in 2 rows along each side of the tail; these spines very sharp; larger and smaller ones alternating in the rows; a large spine in the middle of each shoulder; a spine between the caudal fins. Color brown, with bands, bars, lines, blotches, and spots of darker color in the middle of the pectoral; a translucent space on each side of snout. (Garman.) L. about 2 feet. Cape Cod southward to Florida; not very common. (*eglantina*, the briar rose.)

*Raia eglanteria* (Bosc), Lacépède, Hist. Nat. des Poiss., II, 103, 1800, Charleston, South Carolina; Garman, *l. c.*, 179, 1881; Jordan & Gilbert, Synopsis, 41, 1883.
*Raia diaphana*, Mitchill, Trans. Lit. Phil. Soc. I, 1815, 478, New York.
*Raia desmarestia*, Le Sueur, Jour. Ac. Nat. Sci. Phila., IV, 100, 1824, Florida.
*Raia chantenay*, Le Sueur, *l. c.*, 106, 1824, Delaware Bay.

### 99. RAJA SENTA, Garman.

Form of *R. eglanteria*. Snout projecting, its tip acute and flexible; interorbital space concave, 3⅘ in snout; mouth little curved, ½ preoral part of snout; eyes and spiracles small; teeth in 36 to 40 rows. Tail slender, tapering. Entire upper surface covered with very small, close-set spines, each slender, acute, strongly hooked backward over a broad stellate base; vertebral line with a series of large spines with smaller interspersed; 2 or 3 large, hooked spines before each eye; a few moderate spines on snout and back of head. Olivaceous, clouded with darker, a whitish spot sometimes on middle of back, and a pale bar on back of tail. (Garman.) Banks of Newfoundland to Cape Cod, in deep water. (*sentis*, briar.)

*Raja senta*, Garman, Proc. U. S. Nat. Mus., 1885, 43, Cape Cod Bay; Le Have Bank. (Type, No. 21004 and 24309.)

### 100. RAJA LÆVIS,* (Mitchill).

(Barndoor Skate.)

Angles of the disk more acute than in any of the others; muzzle much produced, somewhat shovel-shaped at tip. Spines of the body very few and small; some present above the eyes and spiracles, on the snout, along the anterior border of the pectorals, and on the back; those on the back very small; a median dorsal row of larger hooked spines extending along the median line of the posterior portion of the back and the tail; usually 2 lateral rows on the tail. Female rougher, as usual among rays. Color variable, brownish, with paler spots, which are usually ringed with darker. The largest of our Atlantic species, reaching a length of 4 feet. New England to Florida; not uncommon northward. (*lævis*, smooth.)

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[*] *Raja granulata*, Gill. Allied to *R. lævis*. Back and ventrals surface covered with minute sharp granular ossifications. Teeth in about 30 rows; claspers slender and scarcely expanded. Slate color, the ventrals with reticulate markings. (Gill.) Banks of Newfoundland; a doubtful species, imperfectly described, apparently not different from *R. lævis*. (*granulatus*, granular )

*Raja lævis*, MITCHILL, Amer. Monthly Mag., II, 327, 1817, New York.

*Raja lævis*, STORER, Hist. Fish. Mass., 1867, 242; GARMAN, *l. c.*, 180, 1881; JORDAN & GILBERT, Synopsis, 41, 1883.

*Raia granulata*, GILL MS., GOODE & BEAN, Bull. Essex. Inst., XI, 1879, 28, Le Have Bank.

### 101. RAJA RHINA, Jordan & Gilbert.

Disk broad, the outer pectoral angle sharp, farther forward than in *R. binoculata*. Anterior outline of pectoral somewhat undulated and exceedingly concave, so that the snout is very long, acuminate, and tapering to the extreme point; interorbital space quite narrow, little concave. Supraocular ridges slightly elevated; eyes large, much longer than spiracles. Spines on body comparatively strong; 5 to 7 above the eyes; 2 or 3 near the middle of the back; none on the median line of the back until opposite the posterior end of ventrals, where a series of rather sharp spines begins; prickles on body above rather large, sharp, strongly stellate, those on the snout largest and most stellate; skin above everwhere prickly in the female; the prickles small and sparse on the base and edges of the pectorals and on ventrals; larger on the median region of the disk. Male with bases of fins smooth, and the prickles generally fewer and smaller; anterior edge of pectoral with spines; under side of disk almost everywhere prickly in the females, smooth posteriorly in the males. Mouth somewhat arched. Teeth $\frac{46}{40}$. Color light brown, nearly plain, with a dark ring at base of pectorals, which grows obscure with age. Disk $\frac{1}{10}$ broader than long, its breadth twice the length of the tail. Snout nearly $\frac{1}{3}$ the length of the disk, 3¾ times the interorbital width. L. 2½ feet. Monterey to Alaska; not rare, especially northward. (*ῥίν*, snout; *ῥίνη*, rasp.)

*Raja rhina*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1880, 251, Monterey; San Francisco.

*Raia rhina*, JORDAN & GILBERT, Synopsis, 45, 1883.

### 102. RAJA BINOCULATA, Girard.

(BIG SKATE OF CALIFORNIA.)

Disk broad, its widest part behind the middle. Snout long, regularly long acuminate, but not very sharp at tip; the anterior outline of the pectoral not much undulated, and little concave; interorbital space very broad, almost flat, slightly depressed in the middle; supraocular ridge scarcely elevated; eyes small, shorter than the spiracles. Spines on body small and few; 2 or 3 small spines around the eye; 1 or 2 near the center of the back; otherwise none on median line of back in front of base of ventrals, where a series of spines begins, feeble anteriorly, but growing larger backward; females (as in other species) with lateral series of spines on the tail; upper surface mostly covered with minute prickles which are largest on the median line of the back, on the tail, and the front of the pectorals. Disk smooth below, except anteriorly. Teeth about $\frac{48}{38}$; the jaws rather strongly arched. Disk $\frac{1}{5}$ broader than long, its width twice the length of the tail; snout 3½ in length of disk, 2¾ in interorbital width. Color brown, with a dark ocellate ring at base of pectorals; upper surface everywhere with round pale spots. The largest of our skates, reaching a length of over 6 feet; the egg case nearly a foot long. Pacific coast from Monterey to Sitka, abundant. (*bis*, two; *oculatus*, eyed, from the pectoral ocelli.)

*Raja binoculata*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 196, San Francisco; JORDAN & GILBERT, Synopsis, 878, 1883.

*Uraptera binoculata*, GIRARD, Pac. R. R. Survey, 373, 1858.

*Raia cooperi*, GIRARD, Pac. R. R. Survey, 372, 1858, Shoalwater Bay, Washington.

*Raia cooperi*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1880, 135.

### 103. RAJA INORNATA, Jordan & Gilbert.

(COMMON SKATE OF CALIFORNIA.)

Disk broad, its widest part well forward; outer angle of pectoral blunt; posterior edge convex; anterior margin of pectoral undulated, not strongly concave; snout rather pointed and projecting at tip, but not very long, its acumination being confined to its anterior half. Interocular space narrow, deeply and uniformly concave; eyes large, longer than spiracles; supraocular ridge prominent. Spines on body rather stronger than in related species; 4 or 5 over the eye; 5 or 6 (rarely fewer) along the median line in front of the middle of the back; a series of very small spines along the middle of the back, changing opposite the middle of the ventrals into a series of rather strong, hooked spines; tail with a strong lateral series in females only, as usual in the genus; prickles on the body small and few; a small band of sparse prickles near the median line of back on each side of the median series of spines; snout and interorbital space prickly; no prickles on the shoulders or on the fins, except the anterior edge of the pectorals; smooth below, except on the snout and front of pectorals; armature variable, smoothest specimens in deeper water. Teeth $\frac{40}{42}$. Jaws somewhat curved. Color light brown, slightly mottled; a blackish ring at base of pectorals, which becomes faint in the adult; a small dusky spot at base of ventrals and on posterior edge of pectorals. Disk $\frac{1}{10}$ broader than long, its breadth twice the length of the tail. Snout $\frac{1}{4}$ the length of the disk, 3 times the interorbital width. L. 2 feet. Coast of California; very abundant from San Diego to Cape Mendocino. (*inornatus*, unadorned.)

*Raja inornata*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1880, 457, and 1881, 74, San Francisco.

*Raia inornata*, JORDAN & GILBERT, Synopsis, 878, 1883.

*Raia jordani*,* GARMAN, Proc. U. S. Nat. Mus., 1885, 43, San Francisco. (Type, 16704.)

*Raia inornata inermis*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1881, 74, Santa Barbara. (Type, No. 26926.)

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* *Raja jordani*, Garman. Disk broader than long, the snout a little sharper than a right angle, the tip pointed; width of disk 1 ½ times length of tail from ventrals; tail slender, tapering regularly to a point. Dorsals separated by a large spine. Interocular space broad, deeply concave, 3 in snout. Eye moderate, as large as spiracle. Mouth wide, curved forward; 1⅔ in preoral part of snout; teeth in 38 rows. Head above, including rostral cartilages and skin between them, rough with small spines; a row of larger spines along orbital ridges and median line of back and tail; type (♂) without lateral spines on tail; 2 large spines side by side in front of and near dorsals; a group of large spines on front of each pectoral; most of the disk smooth. Claspers long, slender, pointed, their form unlike that of *R. erinacea*. Dark olivaceous, a rounded pale spot with a darker center on each shoulder; dark mottlings on lower side. L. 2 feet. (Garman.) San Francisco, apparently not distinct from *R. inornata*. (Named for David Starr Jordan.)

### 104. RAJA EQUATORIALIS, Jordan & Bollman.

Disk to posterior base of pectorals $\frac{1}{3}$ broader than long, the breadth exceeding the length by a distance equal to snout and eye; the breadth somewhat longer than length of tail (measured from vent); anterior margin concave in front of eyes. Snout produced at a rather acute angle, its tip rounded, its length from eye $3\frac{3}{5}$ in length of disk. Interorbital space rather strongly concave, its width $2\frac{2}{5}$ in snout. Eye not much larger than spiracles, 3 in snout. Width of mouth $1\frac{1}{2}$ in prenasal part of head; nasal flaps at angle of mouth deeply fringed. Pectorals reaching middle of ventrals, which are as long as from tip of snout to posterior border of spiracle. Claspers in typical example $1\frac{3}{8}$ in disk. Dorsals small, their length 2 in snout. Caudal small, not longer than eye. Snout above with 2 rows of spines, besides smaller asperities; a row of about 12 before and above eye and spiracle; a row of strong spines along line of back from posterior border of spiracle to second dorsal, these alternately large and small on the tail; a row of similar spines on each side of tail commencing just behind posterior base of ventrals and extending to caudal; a single spine on the shoulder on each side; 4 or 5 irregular rows near the anterior margin of the disk opposite the eyes; the length of this patch not as long as snout. Pectorals with the usual strong retrorse spines characteristic of the males of this genus. Small prickles present along the outer anterior margin of pectorals, interorbital area, on top of snout, and along its margin for a distance equal to $\frac{3}{4}$ of snout, and beneath from tip to opposite posterior teeth, the anterior prickles strongest; a small patch in front of eyes. Teeth $\frac{42}{40}$.

Color light brown, spotted with paler; the back with obscure reticulations of the ground color, forming honeycomb-like markings, surrounding paler; an obscure roundish dusky blotch at middle of base of pectorals, and a darker one near their posterior base; edges of ventrals, pectorals, and snout pale; dark markings on interorbital area and below eye; no markings below.

Related to *Raja inornata*, Jordan & Gilbert, from which it is at once distinguished by having 4 rows of spines below eyes, a series of stout spines on each side of tail in the male, and no prickles on back except the median series and the spine on each shoulder. The size is much smaller, it being one of the smallest of the rays, known from a single male specimen 14 inches in length; dredged at a depth of 33 fathoms, at station 2797, off the west coast of Colombia, between Panama and the Galapagos Islands, 8° 06′ 30″ N., 78° 51′ W. (*equatorialis*, of the equator.)

*Raja equatorialis*, JORDAN & BOLLMAN, Proc. U. S. Nat. Mus., 1889, 150, off Colombia. (Type, No. 41132.)

### 105. RAJA PARMIFERA, Bean.

Disk considerably broader than long; tip of snout slightly projecting; interorbital width $3\frac{1}{2}$ in distance from snout to eye; tail as long as from its root to eye. Teeth in 27 rows. Snout, supraoccipital region and whole margin of pectorals and ventrals covered with small prickles, as also an area on tail; back and tail with a median row of 22 to 29 large spines; tail with a marginal row of large spines (♀); rest of disk mostly smooth; lower side mostly smooth except below snout. Olive brown, with numerous paler blotches, 2 larger than the others. L. 3 feet. Coast of Alaska, common. (Bean.) (*parma*, shield; *fero*, I bear.)

*Raia parmifera*, BEAN, Proc. U. S. Nat. Mus., 1881, 157, Iliuliuk, Unalaska; (Type, No. 27651). JORDAN & GILBERT, Synopsis, 878, 1883.

### 106. RAJA STELLULATA, Jordan & Gilbert.

Disk much broader than long, anteriorly broadly arched; the snout very obtuse, but its tip slightly exserted and acutish; anterior margin of pectorals somewhat undulated and convex; posterior margin very convex. A row of small stoutish spines above eye; about 6 spines on the scapular region, and a median row of strong spines on the tail; entire upper surface rough with strong stellate prickles; these largest on head, middle of back, and on tail; underside smooth, except anteriorly. Teeth $\frac{40}{35}$. Nasal cartilage very weak. Color brown, everywhere strongly variegated with light and dark colors; a black spot at base of each pectoral, surrounded by a pale ring, and this by a black ring; numerous black spots of various sizes, some of them ocellated, scattered over the body; head with black crossbars. Disk $\frac{1}{5}$ broader than long; the length of tail more than $\frac{1}{2}$ the width of disk; the snout $4\frac{1}{2}$ in length of disk, and $2\frac{1}{2}$ times the interorbital width; the snout is as long as in *inornata*, but much wider, appearing blunt and short. L. $2\frac{1}{2}$ feet. Coast of California and northward, Santa Barbara to Unalaska; locally abundant about Monterey. (*stellula*, a small star, from the form of prickles.)

*Raja stellulata*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1880, 133, Monterey; JORDAN & GILBERT, Synopsis, 45, 1883.

### 107. RAJA ALEUTICA, Gilbert & Thoburn.

Closely related to *R. stellulata*, differing in the much finer stellate prickles, which uniformly cover the entire upper side of disk, the continuous series of median spines, the narrower disk, and longer, sharper snout. The latter forms a right angle, its length more than $\frac{1}{3}$ length of disk. Interorbital space deeply concave, the rostral cartilage a slender rod, with semitransparent spaces on either side. Anterior margins of disk gently convex near snout, concave near pectoral angle. Length of tail equaling distance from snout to vent. Teeth $\frac{38}{43}$. No spines or enlarged prickles on orbital rim. Two large spines on shoulder. A broad band of enlarged prickles on each side of tail.

The single specimen is a young male, 33 inches long, taken south of Unalaska Island, Aleutian group, at a depth of 81 fathoms. The species evidently reaches a larger size than either *stellulata* or *parmifera*, as the claspers failed to reach ventral margin, and the pectoral hooks were undeveloped in the type.

*Raja aleutica*, GILBERT & THOBURN, Bull. U. S. Fish Com., 1894; Sannak Island, Aleutians.

### 108. RAJA TRACHURA, Gilbert.

Allied to *Raja isotrachys*, a deep water species, but the disk broader, the snout much blunter, the angle much greater than a right angle. Upper surface sparsely and evenly covered with small sharp prickles with stellate base, crowded between eyes, in a broad band along front of disk, behind shoulders and especially on sides of tail; no spines on orbital rim or shoulders: a small spine on middle of back between shoulders; 23 spines along median line of tail. Anterior outline strongly undulated, convex near tip of snout, which slightly projects. Length of disk 1½ in its width; interorbital space concave, 1⅙ times eye, which is 3⅗ in snout. Distance from front of eye to edge of disk, 1⅖ in snout. Tail longer than body by ½ snout; dorsals small, equal, prickly. Color plum color, darker at margin; brownish below, becoming dark on fins. L. 18 inches. One specimen known from Santa Barbara Channel, in 822 fathoms. (Gilbert.) (*τραχύς* rough; *οὐρά* tail.)

*Raia trachura*, Gilbert, Proc. U. S. Nat. Mus., 1891, 539, Santa Barbara.

### 109. RAJA ABYSSICOLA, Gilbert & Thoburn.

Three strong spines on middle of back and a series down median line of tail. No other spines present. A band of enlarged prickles on each side of tail. Both upper and lower surface hispid with close-set, slender bristles; the margins of disk, the ventrals, and the under surface of tail partly naked. No scapular spines. Anterior margin of disk concave near snout and near pectoral angle, a convex area intervening. Snout broad, but not short nor blunt. Interorbital space deeply concave. Claspers long, slender and flexible. Rostral cartilage imperfect; skeleton generally very flexible. Hooks on pectorals in male imperfectly developed. Nearly uniform sooty brown on both upper and lower sides, with a few scattered black spots above.

A single specimen known, a male 45 inches long, taken off the Queen Charlotte Islands, British Columbia, at a depth of 1,588 fathoms, the greatest depth at which a ray has been found. A strongly marked species, probably type of a distinct genus. (*abyssicola*, living in the depths.)

*Raja abyssicola*, Gilbert & Thoburn, Bull. U. S. Fish Com., 1894, Queen Charlotte Islands.

## Family XXV. NARCOBATIDÆ.

### (The Electric Rays.)

Trunk broad and thick, covered with perfectly smooth skin. Tail comparatively short and thick, with rayed caudal fin, and commonly 2 rayed dorsal fins, the first of which is over or behind the ventrals; a longitudinal fold on each side of the tail; anterior or nasal valves confluent into a quadrangular lobe; a large electric organ composed of many hexagonal tubes between the pectoral fins and the head. Genera 7; species about 15; rays of moderate or large size, noted for their power of giving electric shocks; found in most warm seas. According to Fritsch, the torpedoes pass through 3 distinct phases of development, a shark-like, a ray-like, and finally a torpedo-like stage. The very young have long external gills. (Torpedinidæ, Günther, Cat., viii, 448–455.)

- *a.* Dorsal fins 2.
  - *b.* Ventral fins separate, tail moderate.
    - *c.* Spiracles at some distance behind the eyes.

*d.* Spiracles rounded, with entire edges, (not fringed). TETRONARCE,* 49.
*cc.* Spiracles placed close behind the eyes, not fringed, but with the margin sometimes tuberculate. NARCINE, 50.
*bb.* Ventral fins united ; spiracles close to the eyes, not fringed. DISCOPYGE, 51.

## 49. TETRONARCE, Gill.

*Tetronarce*, GILL, Ann. Lyc. Nat. Hist. N. Y., 1861, VIII, 387, (*occidentalis*).
*Gymnotorpedo*, FRITSCH, Arch. Anat. Phys., 1886, 365, (*occidentalis*).

Electric rays with the disk very broad, abruptly contracted at the tail; 2 dorsal fins; caudal fin well developed; ventral fins large, separate; spiracles large. rounded, with entire (not fringed) edges, placed behind the eyes; mouth small; teeth pointed; skin perfectly smooth. Species about 4, 2 European, the others American. (*τέτρα-*, four—four-cornered; *νάρκη*, an old name of *Tetronarce narce*, meaning numbness, equivalent to *Torpedo.*)

*a.* Color nearly uniform black, rarely spotted ; first dorsal over middle of ventrals. OCCIDENTALIS, 110.
*aa* Color dark brown, usually spotted with black ; first dorsal inserted behind middle of ventrals. CALIFORNICA, 111.

### 110. TETRONARCE OCCIDENTALIS, (Storer).

(CRAMPFISH ; TORPEDO ; NUMBFISH.)

First dorsal more than twice as large as second, its insertion over middle of the ventrals; spiracles not fringed, their edges smooth. Color almost uniform black, with obscure darker spots; beneath white. L. 2 to 5 feet; breadth ¾ of length, the disk very blunt or almost emarginate in front. Atlantic coast of United States, Cape Cod to Cuba; not very common. A large species, allied to the European *T. nobiliana*, said to reach a weight of 200 pounds. According to the figures, *T. nobiliana* has the second dorsal smaller and inserted farther back. (*occidentalis*, western.)

*Torpedo occidentalis*, STORER, Am. Jour. Sci. Arts, 1843, 165, Massachusetts.
*Torpedo occidentalis*, STORER, Fishes Mass., 247, 1867.
*Torpedo occidentalis*, JORDAN & GILBERT, Synopsis, 39, 1883.

### 111. TETRONARCE CALIFORNICA, (Ayres).

(CALIFORNIA TORPEDO.)

Color very dark brown, with small round black spots, which are sometimes obsolete. Eye small; spiracles at a distance behind them more than twice eye and more than length of spiracle; edges of spiracles not fringed; breadth of mouth about equal to its distance from tip of snout; teeth small, sharp. First dorsal more than twice second, half of it opposite ventrals. A large species, reaching a length of about 3 feet. Coast of California, on sandy shores, scarce, rarely seen except about San Francisco and Santa Cruz; not noticed south of Monterey. Perhaps not different from *T. occidentalis.*

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* In the Old World genus *Narcobatus*, the typical genus of the family, the edges of the spiracles are fringed with papillæ. The synonymy of this genus is :

*Torpedo*, DUMÉRIL, Zoöl. Anal., 102, 1806, (*torpedo*) ; name preoccupied for an electric catfish.
*Narcobatus*, BLAINVILLE, Journ. Phys., 1816, 262, (*maculatus*, *galvani*, *etc.*).
*Narcacion*, (KLEIN), BLEEKER, Nederl. Tidskr. Dierk. III, 171, (*torpedo*).
*Fimbriotorpedo*, FRITSCH, Arch. Anat. Phys. 1886, 365, (*marmorata* = *torpedo*).

*Torpedo californica*, AYRES, Proc. Cal. Ac. Sci., 1854, 70, San Francisco.
*Torpedo californica*, JORDAN & GILBERT, Synopsis, 876, 1883.

## 50. NARCINE, Henle.

*Narcine*, HENLE, Ueber Narcine, 31, 1834, (*brasilensis*).
*Cyclonarce*, GILL, Ann. Lyc. Nat. Hist. N. Y., 1861, VIII, 387, (*timlei*).
*Gonionarce*, GILL, *l. c.*, (*indica*).

Disk more or less rounded, not emarginate in front; spiracles very close to the eyes, their edges tuberculate or smooth; mouth narrow, surrounded by a circular fold of skin, which forms the frenum of the nasal valve; teeth in quincunx, not occupying the whole of the jaw, most of them visible when the mouth is closed. Tail about as long as disk; second dorsal larger than first. Warm seas; the species usually smaller than the species of Torpedo. (*νάρκη*, numbness, an old name of the Torpedo).

### 112. NARCINE BRASILIENSIS, (Ölfers).

Disk oval or nearly circular, the snout broadly rounded, not exserted; spiracles with roughened edges; snout 4½ in disk, twice interorbital width; mouth 1⅔ in preoral part of snout; tail 1⅔ times length of disk; second dorsal a little higher and a little longer than first. Color variable, a fact which has given rise to several nominal species; sometimes nearly uniform dark brown (in deep water); sometimes marked above with dark spots and dashes (*umbrosa*); sometimes with a dark band across head and dark spots elsewhere (*corallina*). West Indies and Brazil, occasionally northward to Key West and Pensacola. L. 2 feet.

*Torpedo brasiliensis*, VON ÖLFERS, Torpedo, 19, 1831, Brazil.
*Narcine brasiliensis*, GÜNTHER, Cat., VIII, 453, 1870.
*Narcine brasiliensis corallina*, GARMAN, Bull, Mus. Comp. Zoöl., XI, 234, 1881, Florida; JORDAN & GILBERT, Synopsis, 877, 1883.
*Narcine umbrosa*, JORDAN, Proc. U. S. Nat. Mus., 1884, 105, Key West.
*Narcine brasiliensis*, JORDAN & EVERMANN, Proc. U. S. Nat. Mus., 1886, 472.
*Torpedo bancrofti*, GRIFFITH, Anim. Kingdom, x, 649, pl. XXXIV, 1834, Jamaica.
*Narcine nigra*, DUMÉRIL, Revue Zoöl., 272, 1852, Brazil.
*Torpedo pictus*, GRONOW, Cat. Fishes, 13, 1854, Antilles.

## 51. DISCOPYGE, Tschudi.

*Discopyge*, TSCHUDI, Fauna Peruana, 32,1844, (*tschudii*).

Ventral fins united into a continuous disk below the tail. Disk circular; tail with 2 dorsal fins and with a fold on each side; nasal valves confluent; teeth flat, the hinder edge angular; spiracles close behind eyes. Two species in the Eastern Pacific; small electric rays resembling *Narcine*, but with united ventrals. (*δίσκος*, disk; *πυγή*, rump, from the disk-like ventrals).

### 113. DISCOPYGE OMMATA, Jordan & Gilbert.

Spiracles with coarse fringes. Snout 4½ in disk; eye small; interorbital space 1½ in snout. Width of mouth 1⅔ in preoral part of snout; tail slightly shorter than rest of body; second dorsal narrower and higher than first; ventrals large, adnate behind. Color brown, mottled and spotted above with lighter and darker; center of disk with a large, blackish, ocellated spot, the darker center surrounded by a pale ring, a pale spot at center; ocellus as long as snout. Panama, rare. (*ὀμματός*, eyed, from the color markings.)

*Discopyge ommata*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1889, 151, Panama. (Type, No. 41133.)

## Suborder MASTICURA.

### (The Whip-tailed Rays.)

## Family XXVI. DASYATIDÆ.

### (The Sting Rays.)

Disk usually more or less broad than long; the pectoral fins uninterruptedly confluent in front, forming the tip of the snout; tail variously formed, usually whip-like, sometimes short and stout, sometimes bearing a single dorsal or caudal fin, but never with 2 dorsals; usually 1 or more vertical folds of skin on the tail, rarely a lateral fold. Tail generally armed with a large, sharp, retrorsely serrate spine on its upper surface toward the base; 2 or 3 spines occasionally present. Ventral fins not emarginate. Skin smooth or variously prickly or spinous, roughest in the adult; no differentiated spines on the pectorals in the males, the sexes being similar. Mouth rather small; teeth small, paved, usually more or less pointed or tubercular. Nostrils close together; nasal valves forming a rectangular flap, which is joined to the upper jaw by a narrow frenum. Spiracles large, placed close behind the eyes. Skull not elevated, the eyes and spiracles superior. Ovoviviparous. Genera about 10; species 50. Found in most warm seas, some of them in the fresh waters of the northern parts of South America. The large, jagged spine on the muscular tail is capable of inflicting a severe and even dangerous wound. (Trygonidæ, Günther, Cat., viii, 471–488.)

Urolophinæ:

*a.* Tail stout, provided with a rayed caudal fin; no dorsal fin; disk roundish; caudal spine strong. Urolophus, 52.

Dasyatinæ:

*aa.* Tail slender, without caudal fin; pelvis without sword-shaped* process. (Marine species).

*b.* Tail whip-like, longer than the disk which is rhomboid or roundish; caudal spine strong. Dasyatis, 53.

*bb.* Tail very short, shorter than the very broad, transversely rhombic disk; caudal spine weak, often wanting. No trace of dorsal fin. Pteroplatea, 54.

## 52. UROLOPHUS, Müller & Henle.

### (Round Sting Rays.)

*Leiobatus*, † Blainville, Jour. Phys., lxxxiii, 1816, 262, (*cruciatus;* not *Leiobatus*, Rafinesque, 1810).

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* In the fresh water genera *Ellipesurus* and *Paratrygon*, species of which are found in the waters of Colombia, Venezuela, and Guiana, the pelvis has a sword-shaped continuation or process. See Garman, Proc. Bost. Soc. Nat. Hist., 1877, 210, and Steindachner, Fische des Magdalenenstromes, 1878, 58.

† In the Faune Française, 1828, Blaineville changes "*batus*" in this and all similar names to "*batis*," thus *Leiobatis, Aëtobatis.*

*Urolophus*, Müller & Henle, Plagiostomen, 1838, 173, (*aurantiacus = cruciatus*).
*Urotrygon*, Gill, Proc. Ac. Nat. Sci. Phila., 1863, 173, (*mundus*).

Disk oval or rhombic, the length and breadth not very unequal; snout rounded or the tip exserted; skin smooth or more or less prickly. Tail rather short, little if any longer than the disk, muscular, provided with a distinct rayed caudal fin; no dorsal fin. Upper part of the tail with a strong serrated spine. Warm seas. Sting rays of small size, the most vigorous and most dangerous of the group, mostly confined to tropical America. (*οὐρά*, tail; *λόφος*, crest.)

- *a.* Middle line of back or tail with no enlarged shields, spines or prickles, the skin smooth or with prickles similar to those found elsewhere; disk roundish, the snout not prominent.
  - *b.* Skin everywhere perfectly smooth; snout little prominent; tail shorter than disk; body with yellow streaks and spots. HALLERI, 114.
  - *bb.* Skin more or less prickly above.
    - *c.* Skin mostly smooth, some weak prickles present on middle of back. NEBULOSUS, 115.
    - *cc.* Skin above everywhere beset with small prickles.
      - *d.* Tail rather shorter than disk, which is longer than broad. Color brown, everywhere sprinkled with yellow dots. JAMAICENSIS, 116.
      - *dd.* Tail rather longer than disk, the caudal spine inserted behind its middle; disk as broad as long; prickles stellate. Color plain brownish. MUNDUS, 117.
- *aa.* Middle line of back or tail with 1 or more enlarged spines or prickles; tip of snout more or less prominent. Color nearly plain.
  - *e.* Middle of back with 1 or 2 stout spines; no spines on tail; rest of disk smooth or slightly prickly; disk broader than long, shorter than tail. GOODEI, 118.
  - *ee.* Middle of back without differentiated spines; median line of tail with spines.
    - *f.* Median line of tail with 2 to 8 strong, broad rooted spines; rest of body entirely smooth; tail longer than disk which is slightly longer than broad; the snout strongly projecting. ASPIDURUS, 119.
    - *ff.* Median line of back and tail with 18 to 22 recurved spinules; these largest on tail; disk above mostly covered with small stellate prickles; snout slightly projecting; tail as long as disk, which is slightly broader than long. ASTERIAS, 120.

### 114. UROLOPHUS HALLERI, Cooper.

Disk nearly round, a little broader than long, with the anterior margins straightish, meeting in a slight angle. Snout (from the eyes) longer than the width of the interorbital space; less than ¼ disk. Tail somewhat shorter than the disk. Teeth obtuse in both sexes. Skin perfectly smooth, without spines or prickles. Color light brownish, with marblings and wavy lines of yellowish and dusky, sometimes with yellowish spots, occasionally with wide, obscure dusky streaks, which are crossed by similar transverse streaks; belly yellowish tinged. Coast of California from Point Concepcion southward to northen Mexico; exceedingly abundant in sheltered bays. L. 12 inches. The smallest of our sting rays. Closely related to the Australian *U. cruciatus*. (Named for Mr. Haller, of Port Townsend, Washington, who, as a boy, was stung by this species at San Diego in 1862.)

*Urolophus halleri*, Cooper, Proc. Cal. Ac. Sci., 1863, III, 95, San Diego; Jordan & Gilbert, Synopsis, 46, 1883.

### 115. UROLOPHUS NEBULOSUS, Garman.

Disk nearly round, formed much as in *U. halleri*. Skin not quite smooth, some asperities present about the middle of the back; no median series of spines on back or tail; mouth with 3 small papillæ. Color clouded olivaceous above, whitish below. Gulf of California to Panama; not rare, replacing *U. halleri* southward, and differing chiefly in the prickly back. (*nebulosus*, clouded.)

*Urolophus nebulosus*, Garman, Proc. U. S. Nat. Mus., 1885, 41, Colima. (Type, No. 7356.)

### 116. UROLOPHUS JAMAICENSIS, (Cuvier).

Disk ovate, longer than broad, rather longer than tail, its front rounded, the snout not projecting. Skin above everywhere sparsely covered with small prickles. Color brown, sprinkled with small yellow spots, edged with darker. West Indies, generally common; once (perhaps erroneously) recorded from New Jersey.

*Leiobatus sloani*, Blainville, Journ. Phys., 1816, 262, name only.
*Raja jamaicensis*, Cuvier, Règne Animal, ii, 137, 1817, Jamaica, after Pastinaca Marina of Sloane.
*Trygonobatus torpedinus*, Desmarest, Prém. Déc. Ichth., 6, 1823, Cuba.
*Urolophus torpedinus*, Günther, Cat., viii, 485, 1870; Garman, Proc. U. S. Nat. Mus., 1885, 43.
*Raja sloani*, Bancroft, Zoöl. Journal, v, 83, 1829, Jamaica.

### 117. UROLOPHUS MUNDUS, (Gill).

Disk orbicular, rounded in outline; the snout slightly projecting, as long as broad; tail a little longer than disk; caudal spine inserted a little behind middle of tail; as long as from nostrils to tip of snout; teeth pointed. Skin beset with numerous small stelliform tubercles, largest on the back. Color uniform dark brown. (Gill.) Panama; not seen by us. (*mundus*, clean.)

*Urotrygon mundus*, Gill, Proc. U. S. Nat. Mus., 1863, 173, Panama.

### 118. UROLOPHUS GOODEI, Jordan & Bollman.

Disk broader than long, by a distance equal to snout and ½ eye; front margins of disk slightly convex, the tip of snout exserted and sharply pointed, its length 3¾ in length of disk; eye equal to spiracle, 3¼ in snout; edge of spiracles entire; width of mouth 2 in snout before it; ventrals projecting beyond disk, their length 1¼ in their breadth. Caudal spine large, as long as snout and ½ eye, its edge with 8 to 10 retrorse spinules, its insertion before middle of tail (from axil of pectoral), its tip reaching front of caudal; tail longer than disk by a distance equal to eye and spiracle; skin smooth or somewhat prickly on upper surface of snout; 1 or 2 strong spines near middle of back. Color plain brown, nearly uniform, the margins bright yellow in life. About Panama, at a depth of 33 fathoms; also taken in Magdalena Bay; snout longer, 3 in disk (Gilbert.) (Named for George Brown Goode.)

*Urolophus goodei*, Jordan & Bollman, Proc. U. S. Nat. Mus., 1889, 151, near Panama. (Type, No. 41150.)

### 119. UROLOPHUS ASPIDURUS, Jordan & Gilbert.

Disk very slightly longer than broad, its length slightly less than tail, its anterior margins nearly straight, the tip of snout projecting abruptly as a narrow triangular prominence, rounded at end; snout from eye 3 in disk; eyes small, much less than spiracles. Mouth 2½ in its distance from snout. Caudal spine very large, a little more than twice interorbital width, its insertion in front of middle of tail. Skin entirely smooth, except for a series of a few (2 to 8) strong, broad-rooted spines or bucklers on upper part of tail before caudal spine; these are straight, sharp, directed backward, their height equal to width at base, which is greater than pupil. Color plain brown. L. 18 inches. Panama. (*ἀσπίς*, shield; *οὐρά*, tail.)

*Urolophus aspidurus*, JORDAN & GILBERT, Bull. U. S. Fish Com., 1881, 307, Panama. (Type, Nos. 29410; 29307; 29454.)

### 120. UROLOPHUS ASTERIAS, Jordan & Gilbert.

Disk almost round, a little broader than long, about as long as tail; anterior margins of disk nearly straight, the tip acute, slightly exserted. Snout, from eye, 4 in disk. Eyes small, much smaller than spiracles, about ½ interorbital width. Mouth 2⅙ in distance to tip of snout. Teeth sharp in males, pavement-like in females. Caudal spine very long, longer than snout, inserted in front of middle of tail. Skin above everywhere covered with small stellate prickles, these larger and more numerous on median line; ventrals smooth; both sexes equally rough; median line of back with a series of 18 to 32 sharp, recurved, spinules, from shoulders to caudal spine, these becoming larger and sharper backward, but all much smaller than the prickles in *U. aspidurus*. Color plain light brown. Mazatlan to Panama, not rare. (*ἀστήρ*, a star, from the stellate spines.)

*Urolophus asterias*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 579, Mazatlan; Panama. (Type, Nos. 28204; 29524; 29542; 29058; 29318.)

## 53. DASYATIS, Rafinesque.

### (STING RAYS.)

*Dasybatus*, KLEIN, 1742, (pre-Linnæan).
*Dasyatis*, RAFINESQUE, Caratteri di Alcuni Nuovi Gen., 16, 1810, (*ujus*=*pastinaca*).
*Uroxis*, RAFINESQUE, Indice d'Ittiol. Sicil., 61, 1810, (*ujus*).
*Trigonobatus*, BLAINVILLE, Jour. Phys., 1816, 261, (*vulgaris*).
*Trygon*, (ADANSON), CUVIER, Règne Animal, Ed. I, 136, 1817, (*pastinaca*).
*Hemitrygon*, MÜLLER & HENLE, Mag. Nat. Hist., 1837, 90, (*bennetti*).
*Himantura*, MÜLLER & HENLE, Wiegmann's Archiv., 1837, 400, (*uarnak*).
*Pastinaca*, SWAINSON, Classn. Anim., 319, 1839, (*olivacea*).
*Anacanthus*, EHRENBERG, in SWAINSON, *l. c.*, (*orbicularis*).
*Pastinaca*, DE KAY, N. Y. Fauna: Fishes, 373, 1842, (*pastinaca*).
*Dasibatis*, GARMAN, in JORDAN & GILBERT, Synopsis, 65, 1883, (*pastinaca*; corrected orthography).

Disk oval, flat, with rounded angles. Tail very long and slender, whiplike, without fin, but often with 1 or 2 vertical membranous folds; a strong serrated spine toward the base of the tail. Skin more or less spinous or prickly, rarely smooth. Teeth small, paved; a few papillæ usually present in the mouth behind the lower jaw. Species about 30. Sting rays of large size, abundant in warm seas. Many of the spinous species are nearly or quite smooth when young, becoming rough with age. Some of our species are yet imperfectly known and much of the synonymy is uncertain. (*δασύς*, shaggy or rough; *βατίς*, a skate; abbreviated from *Dasybatis*.)

HEMITRYGON, (ἡμι-, half; τρυγών, Trygon, a dove, the same name also applied to the sting rays):
*a.* Tail with a keel or wing-like expansion below only; adult with stout bucklers on back and tail; tail rough, more than twice length of disk. CENTRURA, 121.
DASYATIS:
*aa.* Tail with a narrow keel or expansion both above and below.
  *b.* Tail simply keeled above, with a wing-like expansion below.
    *c.* Shoulder with 3 series of tubercles; tail less than twice length of disk. HASTATA, 122.
    *cc.* Shoulder with less than 3 series of tubercles.
      *d.* Tail round, more than twice disk; back with strong tubercles; snout sharp. GYMNURA, 123.
  *bb.* Tail more or less compressed, with a wing-like expansion above, a larger one below.
    *e.* Skin more or less prickly in adult, with a median series of tubercles on back.
      *f.* Tail more than ½ longer than disk.
        *g.* Disk subcircular, the snout prominent. SABINA, 124.
        *gg.* Disk subquadrangular, the snout blunt. LONGA, 125.
      *ff.* Tail not ½ longer than disk; disk subquadrangular, the snout blunt. DIPTERURA, 126.
    *ee.* Skin nearly or quite smooth in adult; median line of back not prickly or with but 1 spine. SAY, 127.

### Subgenus HEMITRYGON, Müller & Henle.

### 121. DASYATIS CENTRURA, (Mitchill).

(COMMON STING RAY; STINGAREE; CLAM CRACKER.)

Disk quadrangular, about ¼ wider than long. Anterior margins sinuous, concave opposite the eyes, convex toward the slightly protuberant snout and rounded outer angles; posterior margin straighter, very little convex; inner convex; hinder angles blunt. Ventrals truncate, with rounded angles. Tail more than twice as long as the disk, much compressed, rounded above, with keel or cutaneous expansion below, with 1 or more strong serrated spines at the termination of the anterior fifth of its length, rough on all sides with spines or tubercles. Till half grown, the young are smooth; as they approach maturity, broad stellate-based, conical-pointed, irregularly placed bucklers appear on the middle of the hinder part of the back and on top and sides of the tail; very large examples have the central portion of the back closely mailed with small flattened tubercles. Mouth arched forward, with 5 papillæ; teeth in quincunx, blunt, smooth. Color on back and tail olive brown; nearly white below. From *D. pastinaca*, the common sting ray of Europe, which this species resembles in shape, it is distinguished by the tubercles, by the length and compression of the tail, and absence of all trace of keel or expansion on its upper side. (Garman.) Coast of Maine to Cape Hatteras, abundant, reaching a length of 10 to 12 feet. (*κέντρον*, spine; *οὐρά*, tail.)

*Raja centrura*, MITCHILL, Trans. Lit. Phil. Soc. N. Y., I, 479, 1815, New York.
*Dasibatis centrura*, JORDAN & GILBERT, Synopsis, 67, 1883.

### Subgenus DASYATIS.

### 122. DASYATIS HASTATA, (De Kay).

Disk quadrangular, about ¼ wider than long; anterior margins nearly straight, meeting in a blunt angle on the end of the snout, curved near the outer angle to meet the slightly convex posterior margins; inner borders convex; outer and hinder angles rounded. Ventrals almost entirely covered by the pectorals, their hinder margins convex. Tail more than 1½ times the length of the disk, low-keeled on the upper side, a long, broad, membranous expansion below, roughened with small asperities; 1 or more serrated spines. Body smooth in young; very old with scattered small asperities; a row of narrow compressed tubercles along the middle of the back and on the base of the tail; the points of these tubercles are depressed and directed backward. On each shoulder, parallel with the median row, there is a shorter row, the length of which varies according to age. Mouth with 3 papillæ. Jaws with more curvature than those of *centrura* and less than those of *sabina;* young without tubercles. Color bluish or olivaceous brown, pale below. West Indies to Brazil, north to Florida, the original description from a specimen taken in Rhode Island. (*hastatus*, armed with a spear.)

*Trygon hastata*, De Kay, N. Y. Fauna: Fishes, 373, pl. 65, fig. 214, ♀, 1842, Rhode Island.
*Trygon hastata*, Storer, Syn. Fish. N. Amer., 261, 1846.
*Trygon hastata*, Duméril, Elasmobranches, 592, 1870.
*Dasibatis hastata*, Jordan & Gilbert, Synopsis, 70, 1883.

### 123. DASYATIS GYMNURA, (Müller).

Disk quadrangular, a little wider than long. Snout produced, sharp-pointed; anterior and posterior margins nearly straight, the anterior curved near the outer angle to meet the posterior, and the latter curved near the hinder angle to meet the inner. Tail nearly 3 times the length of the disk, with a slight ridge above and a narrow cutaneous expansion below, roughened with small spines similar to those on the head; a row of elongated tubercles on the back and anterior portion of tail, and 1 or more smaller ones on each shoulder; the posterior tubercles of the median row much elongated, so as to resemble the spines. Mouth much undulated, with 3 papillæ; teeth small, unequal. Young without tubercles; as the animal grows older a few scattered asperities appear on the head; still later these increase in number and size to such an extent as to cover the head and back with a heavy coat of mail made up of closely set flattened scales; the tubercles of the back cease growing as the scales enlarge, and ultimately there is little distinction between them; usually the tubercle on the middle of the pectoral arch is larger; those on the tail continue to increase in size with age. Disk wider than long; tail 3 times length of disk. Color yellowish to olivaceous brown, darkening with age. (Garman.) Surinam to Brazil, recorded from Grenada by Günther, otherwise not known from the West Indies. (*γυμνός*, naked; *οὐρά*, tail.)

*Raie tuberculée*, Lacépède, II, 106, pl. 4, fig. 1, 1800, Cayenne.
*Raia tuberculata*, Shaw, Genl. Zool., V, 290, 1804, after Lacépède, not of Bonnaterre, 1788.
*Trygon gymnura*, J. Müller, Ermann's Reise um die Erde, 25, taf. 13, 1830, Brazil.
*Trygon osteosticta*, J. Müller, *l. c.*, 25, taf. 14, 1830, Brazil.
*Trygon tuberculata*, Günther, Cat., VIII, 480, 1870.
*Dasibatis tuberculata*, Jordan & Gilbert, Synopsis, 66, 1883.

### 124. DASYATIS SABINA, (Le Sueur).

Disk subcircular. Snout produced, blunt. Anterior margins of the pectorals concave near the snout, becoming convex toward the broadly rounded outer extremities; hinder and inner margins convex. Upper jaw with a deep indentation, receiving a corresponding prominence on the lower. Teeth at the sides of this indentation much larger; mouth with 5 papillæ. Tail less than twice as long as the disk, tapering to a fine point, rough with small prickles, similar to those scattered over the head and back, a cutaneous expansion above, and a broader, longer one below; these end nearly opposite each other, the lower extends forward under the spine. A median row of tubercles on the dorsum and 1 or a pair on each shoulder. Distinguished from *D. gymnura* by the shape of the snout, the rounded pectorals, the shorter tail, the larger teeth, the greater curvature of jaws, the smaller size, and the 2 cutaneous expansions. Proportional length of body and tail as 4½ to 8; in no case is the tail twice as long as the disk. Color ochraceous brown. Streams and estuaries of Florida, abundant on both coasts; several specimens were taken in Lake Monroe, at a distance from salt water. (Garman.)

*Trygon sabina*, LE SUEUR, Jour. Ac. Nat. Sci. Phila., IV, 109, 1824, Florida.
*Dasibatis sabina*, JORDAN & GILBERT, Synopsis, 68, 1883.

### 125. DASYATIS LONGA, Garman.

Disk quadrangular, about $\frac{1}{6}$ wider than long. Margins nearly straight, anterior meeting in a blunt angle on the end of the snout. Outer angles rounded, posterior blunt. Ventrals rounded. Tail variable in length, usually more than twice as long as the body, roughened with small asperities, depressed anteriorly, compressed behind the spine, keeled above the compressed portion, with a long, narrow, cutaneous expansion on the lower side. Mouth curved, with 5 papillæ; a row of small tubercles behind the head on the shoulder girdle. Larger specimens probably with tubercles on back and tail. Gulf of California to Panama. Perhaps not distinct from *D. dipterura*, from which it usually differs in the slightly longer tail, and perhaps in the presence of 5 papillæ instead of 3 in the mouth. (*longus*, long.)

*Dasibatis longa*, GARMAN, Bull. Mus. Comp. Zoöl., VI, 170, 1880, Acapulco; Panama; JORDAN & GILBERT, Synopsis, 66, 1883.

### 126. DASYATIS DIPTERURA, Jordan & Gilbert.

Disk rhomboid, slightly broader than long, its anterior margins nearly straight, meeting anteriorly in a very obtuse angle; posterior margins curved; lateral angles rounded; tail variable, usually ½ longer than the disk, with a conspicuous cutaneous fold below and a smaller but evident one above; jaws considerably arched; buccal papillæ 3; teeth $\frac{2}{2}\frac{1}{3}$. Young perfectly smooth; adult with a row of low but rather stout tubercles on the median line of the scapular region and 2 others on the humeral region; tail with small prickles; caudal spine long, its length nearly 3 times the width of the mouth. Color bluish brown, nearly plain. L. 6 feet or more. Bay of San Diego, and southward; locally abundant. (*δίς*, two; *πτερόν*, wing; *οὐρά*, tail.)

*Dasybatis dipterurus*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1880, 31, San Diego.
*Dasibatis dipterura*, JORDAN & GILBERT, Synopsis, 71, 1883.

### 127. DASYATIS SAY, (Le Sueur).

(SOUTHERN STING RAY.)

Disk quadrangular, ⅙ wider than long, anterior margins nearly straight, posterior and inner borders convex, outer and posterior angles rounded. Snout not protruding beyond the lines of the margins. Ventrals rounded. Tail strong, rather more than 1½ times the length of the disk, with a strong serrated spine, bearing a short, low, cutaneous expansion behind the spine on the upper side, and a longer, little wider one below, ending nearly opposite. Upper jaw undulated; lower prominent in the middle. Teeth small, smooth in young and females, sharp in adult males; 3 papillæ at the bottom of the mouth, and 1 at each side. Body and tail smooth. Color olive brown in adult, reddish or yellowish in young; lower surface whitish. Closely resembles the European species, *D. pastinaca*. In *D. say*, the anterior margins form a more blunt angle at the end of the snout, which is less prominent at the apex, the outer and posterior extremities of the pectorals are rounder, the posterior margins are more convex, the disk is broader toward the ventrals, and the tail is longer; in *D. pastinaca* the lateral and hinder angles of the pectorals and the lateral angle of the ventrals are marked by blunted corners; a single small rounded tubercle on the middle of the back. Carolina to Brazil, common in Florida, occasional northward to New York. (Garman.) (Named for Thomas Say.)

*Raja say*, LE SUEUR, Jour. Ac. Nat. Sci. Phila., I, 42, 1817, New Jersey.
*Myliobatis sayi*, DE KAY, N. Y. Fauna: Fishes, 376, 1842.
*Trygon sayi*, DUMÉRIL, Elasmobranches, 603, 1870.
*Dasibatis sayi*, JORDAN & GILBERT, Synopsis, 69, 1883.

## 54. PTEROPLATEA, Müller & Henle.

*Pteroplatea*, MÜLLER & HENLE, Plagiostomen, 168, 1838, (*altavela*).

Disk much broader than long, its anterior margins meeting in a very obtuse angle, its outer angles more or less acute, the form, therefore, transversely rhombic. Tail very short and slender, shorter than the disk, without fin, armed with a very small serrated spine, which is often wanting. Skin smooth or very nearly so. Size rather large. Warm seas. The species are closely related. (πτερόν, fin; πλατύς, broad; an ancient name of *P. altavela*.)

*a.* Spiracle without tentacle.
  *b.* Front of disk with a row of close-set paler spots or half spots.
    *c.* Disk scarcely twice as broad as long; upper surface finely marbled with grayish mottlings, besides specks; tail with 4 cross blotches. MACLURA, 128.
    *cc.* Disk twice as broad as long; upper surface with thick-set dark points. CREBRIPUNCTATA, 129.
  *bb.* Front of disk without distinct pale spots; dark markings above forming reticulations around pale spots; tail without dark cross blotches. MARMORATA, 130.

### 128. PTEROPLATEA MACLURA, (Le Sueur).

(BUTTERFLY RAY.)

Disk scarcely twice as broad as long, covered with perfectly smooth skin. Tail about ⅓ as long as the disk, with a very slight dermal fold above and below. Snout a little projecting, so that the anterior edge of each pectoral is somewhat concave. Color brownish olive, finely marbled with grayish, and finely speckled; anterior edge of disk with half spots of paler; tail with 4 dark blotches above, forming half rings. (Caudal spine wanting in all the specimens examined.) Long Island to Brazil; not uncommon on the Carolina coast. (Named for William Maclure, founder of the Academy of Natural Sciences at Philadelphia.)

*Raia maclura*, LE SUEUR, Jour. Ac. Nat. Sci. Phila., 1817, 41, Rhode Island; DUMÉRIL, Elasmobranches, I, 614, 1870.
*Pteroplatea maclura*, GÜNTHER, Cat., VIII, 487, 1870; JORDAN & GILBERT, Synopsis, 46, 1883.

### 129. PTEROPLATEA CREBRIPUNCTATA, Peters.

Breadth of disk twice the distance from tip of snout to vent. Snout with a blunt projection; anterior margin of pectorals undulate, convex anteriorly and posteriorly, medially weakly concave; outer angle sharply rounded; posterior margins weakly convex, the posterior angle rounded, covering outer half of base of ventrals; spiracle without tentacle; tail with a low fold on its upper edge. Brown above, with thick-set black points; a row of small close-set yellow spots on front of disk. Gulf of California and southward, along the west coast of Mexico; common. (*creber*, abundant; *punctatus*, spotted.)

*Pteroplatea crebripunctata*, PETERS, Monatsber. Berl. Akad., 703, 1869, Mazatlan.

### 130. PTEROPLATEA MARMORATA, Cooper.

Disk about twice as broad as long, covered with perfectly smooth skin. Tail 3⅔ in length of disk, with a rather small cutaneous fold above and below, the lower fold the longer, the upper about as deep. Interorbital space a little shorter than the snout. Snout slightly prominent, but forming a very obtuse angle. Olive brown, finely mottled everywhere with darker, the dark forming reticulations around pale roundish spots; tail without dark rings. Caudal spine very small, present in all specimens examined. Coast of California from Point Concepcion southward to Cerros Island; common. (*marmoratus*, marbled.)

*Pteroplatea marmorata*, COOPER, Proc. Cal. Ac. Sci., III, 112, 1863, San Diego; JORDAN & GILBERT, Synopsis, 47, 1883.

## Family XXVII. MYLIOBATIDÆ.

### (THE EAGLE RAYS.)

Disk broad; the pectoral fins not continued to the end of the snout, but ceasing on the sides of the head and reappearing in front of the snout as 1 or 2 fleshy protuberances (cephalic fins), which are supported by fin rays. Tail very long and slender, whip-like, with a single dorsal fin near its root, behind which is usually a strong retrorsely serrated spine. Nasal valves forming a rectangular flap, with the posterior margin free, attached by a frenum to the upper jaw. Skull less depressed than usual among rays, its surface raised so that the eyes and spiracles are lateral in position. Teeth hexangular, large, flat, tessellated, the middle ones usually broader than the others. Ovoviviparous. Skin smooth; no differentiated spines on the pectorals in the males, the sexes being similar. Ventrals not emarginate. Genera 3; species about 20. Large sting rays; inhabiting warm seas, feeding chiefly on mollusks which they crush with their large grinding teeth. (Group MYLIOBATINA, Günther, Cat., VIII, 488–495.)

AËTOBATINÆ:
- *a.* Teeth in a single series, very broad; muzzle entire. AËTOBATUS, 55.

RHINOPTERINÆ:
- *aa.* Teeth in several series, the middle series very broad.
  - *b.* Muzzle entire. MYLIOBATIS, 56.
  - *bb.* Muzzle emarginate; cephalic fins below the level of the disk. RHINOPTERA, 57.

## 55. AËTOBATUS, Blainville.

*Aëtobatus*, BLAINVILLE, Jour. de Phys., LXXXIII, 1816, 261, (*vulgaris*, *narinari*, etc.).
*Aetobatis*, BLAINVILLE, Faune Française, Livr. 26, 38, 1828, (*aquila*, *etc.*).
*Aëtobatis*, MÜLLER & HENLE, Plagiostomen, 179, 1838, (*narinari*, first restriction).
*Stoasodon*, CANTOR, Catalogue Malayan Fishes, 434, 1850, (*narinari*, substitute for *Aëtobatis*; restricted to *aquila*).
*Goniobatis*, AGASSIZ, Proc. Bost. Soc. Nat. Hist., 1859, 385, (*flagellum*).

General form of *Myliobatis*. Muzzle entire. Teeth flat, broad, forming a single series corresponding to the middle series in *Myliobatis*, there being no small lateral teeth. Upper dental lamina straight, lower curved, the latter projecting beyond the upper. Free border of the nasal valve deeply emarginate. Skin smooth. Tropical seas. (*ἀετός*, eagle; *βάτος*, ray).

- *a.* Disk twice as broad as long; pale spots rather small. Atlantic Coast. NARINARI, 131.
- *aa.* Disk more than twice as broad as long; pale spots large. Pacific Coast. LATICEPS, 132.

### 131. AËTOBATUS NARINARI, (Euphrasen).

(SPOTTED STING RAY.)

Disk twice as broad as long, its anterior borders a little convex, posterior concave, outer angles pointed. Cephalic fin about ½ broader than long. Teeth of the lower jaw straight or more or less angularly bent. Tail 3 to 4 times length of disk. Brown, with small round pale spots. (Duméril.) Tropical seas, north on the Atlantic coast to Virginia; not very common on our shores. (*narinari*, a Brazilian name.)

*Raia narinari*, EUPHRASEN, Vet. Ak. Nya Handl., XI, 217, 1790, Brazil, (after *narinari* of Marcgrave).
*Raia flagellum*, BLOCH & SCHNEIDER, Syst. Ichth., 361, 1801, Coromandel.
*Aëtobatis narinari*, GÜNTHER, Cat., VIII, 492, 1870; DUMÉRIL, Elasmobranches, 641, 1870.
*Raja quinqueaculeata*, QUOY & GAIMARD, Voy. Uranie., 200, 1824.
*Stoasodon narinari*, JORDAN & GILBERT, Synopsis, 879, 1883.
*Myliobatis eellenkee*, RÜPPELL, Neu. Wirb., 70, 1835, Red Sea.
*Goniobatis macroptera*, MCCLELLAND, Calcutta Jour. Nat. Hist., 1841, I, 60, Bengal.

### 132. AËTOBATUS LATICEPS, (Gill).

Disk rather more than twice as broad as long; fontanelle on top of head gradually expanding backward; tail 4 to 5 times length of disk. Bluish black with numerous rounded yellowish spots on head smaller than eye, much larger on body, assuming on the pectoral the form of ocelli. Gulf of California to Panama, abundant southward. (*latus*, broad; *-ceps*, head).

*Aëtobatis laticeps*, Gill, Ann. Lyc. Nat. Hist. N. Y. 1865, 137, locality unknown, received from San Francisco. It has never been properly compared with *A. narinari*, and may not be different.

## 56. MYLIOBATIS, Duméril.

### (Eagle Rays.)

? *Cephaleutherus*, Rafinesque, Indice Ittiol. Sicil., 61, 1810, (*maculatus*, probably a deformed ray).
*Myliobatis*, Duméril in Cuvier, Règne Animal, Ed. 1, ii, 137, 1817, (*aquila*).
*Holorhinus*, Gill, Proc. Ac. Nat. Sci. Phila., 1862, 331 (*vespertilio* = *californicus*).

Disk broad, the outer angles acute. Cephalic fins forming a soft convex appendage in front of snout. Jaws about equal. Median teeth very broad, much broader than long in the adult, proportionally narrower in the young. Several series of narrower teeth on each side of the median series; teeth changing considerably with age. Free edge of the nasal valve not deeply emarginate. Tail very long and slender, with a small dorsal fin, and one or more serrated spines. Skin smooth or nearly so. Size large. In all warm seas. (*μυλίας*, grinder; *βατίς*, ray.)

Myliobatis:
- *a.* Ventral fins moderate.
  - *b.* Teeth of main row 4 to 6 times as broad as long; skin smooth. freminvillei, 133.

Holorhinus, (ὅλος, solid; ῥίν, snout):
- *aa.* Ventral fins large; rhomboid, broader than long.
  - *c.* Teeth of main row 3 to 4 times as broad as long. californicus, 134.

### Subgenus MYLIOBATIS.

### 133. MYLIOBATIS FREMINVILLEI, Le Sueur.

Disk broader than long; the breadth equal to the length of the tail. Ventral fins much narrower than in *C. californicus*. Skin entirely smooth. A blunt, whitish prominence over each eye. Muzzle prominent. Teeth of the main row 4 to 6 times as broad as long; small teeth in 3 rows. Reddish brown; tail nearly black. Cape Cod to Brazil; not uncommon. (For Chrétien Paulin de Fréminville, a French naturalist.)

*Myliobatis fréminvillei*, Le Sueur, Jour. Ac. Nat. Sci. Phila., iv, 111, 1824, Rhode Island.
*Myliobatis bispinosus*, Storer, Proc. Bost. Soc. Nat. Hist., i, 1841, 53, Massachusetts.
*Myliobatis bispinosus*, Duméril, Elasmobranches, 637, 1870.
*Myliobatis acuta*, Ayres, Proc. Bost. Soc. Nat. Hist., i, 65, 1841, Connecticut.
*Myliobatis fréminvillei*, Jordan & Gilbert, Synopsis, 51, 1883.

### Subgenus HOLORHINUS, Gill.

### 134. MYLIOBATIS CALIFORNICUS, Gill.

(California Sting Ray; Batfish.)

Disk not quite twice as broad as long; the wings anteriorly convex, posteriorly somewhat concave. Cephalic fin very blunt, nearly 4 times as broad as long. Tail nearly twice as long as the disk. Ventral large, broader than long. Lateral teeth in 3 to 5 series on each side; median teeth only 3 to 4 times as broad as long, even in the adult. Skin wholly smooth. Color dusky brownish; the young somewhat variegated.

California from Cape Mendocino southward; very common along mud flats. Destructive to oysters.

*Rhinoptera vespertilio*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 137, Tomales Bay; not *Myliobatis vespertilio*, BLEEKER, also a *Myliobatis*.
*Holorhinus vespertilio*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 331.
*Myliobatis californicus*, GILL, Ann. Lyc. Nat. Hist. N. Y., 1865, 137, (after Girard).
*Myliobatis californicus*, JORDAN & GILBERT, Synopsis, 51. 1883.

## 57. RHINOPTERA, Kuhl.

*Rhinoptera*, (KUHL), CUVIER, Règne Animal, Ed. 2, 1828, (*marginata*).
*Zygobatis*, AGASSIZ, Poissons Fossiles, III, 79, 1836, (*jussieui*).
*Mylorhina*, GILL, Ann. Lyc. Nat. Hist. N. Y., 1865, 136, (*lalandi*).
*Micromesus*, GILL, *l. c.*, (*adspersus*).

Disk broader than long, with the anterior angles more or less acute. Snout more or less emarginate on the median line. Cephalic fin emarginate and placed on a plane below the level of the pectorals, the snout thus appearing 4-lobed. Free border of the nasal valve not emarginate. Teeth in 5 to 20 rows, the median teeth enlarged or not, but often smaller than in *Cephaleutherus*. Tail long, whip-like, with a small dorsal fin and a serrated spine. Tropical seas. The species vary considerably in their dentition. (*ῥίν*, snout; *πτερόν*, fin.)

RHINOPTERA:
- *a.* Teeth of middle of upper jaw much broader than those of sides, the lateral teeth gradually diminishing.
  - *b.* Teeth in 7 rows; the median teeth above about 4 times as broad as long; breadth of disk 1¼ times its length. BONASUS, 135.
  - *bb.* Teeth in 7 rows, the median teeth 3¾ times as broad as long; breadth of disk 1¾ times its length. STEINDACHNERI, 136.

MICROMESUS (*μικρός*, small; *μέσος*, middle):
- *aa.* Teeth of middle of upper jaw not much larger than the outer teeth; teeth in many series.
  - *c.* Teeth of lower jaw in about 15 series; the teeth unequal but all small, the broadest being those of the 6th to 8th series from the side which are twice as broad as long. ENSENADÆ, 137.

### Subgenus RHINOPTERA.

### 135. RHINOPTERA BONASUS, (Mitchill).

(COW-NOSE RAY.)

Disk ½ broader than long; anterior borders almost straight, posterior undulated; muzzle deeply emarginate; teeth in 7 rows in each jaw, the median teeth above 4 times as broad as long, the others gradually diminishing outward. Tail very slender, a little longer than the disk. Skin smooth or nearly so. Color brownish. Cape Cod to Florida; not rare; feeds on mollusks.* (*bonasus*, buffalo.)

*Raja bonasus*, MITCHILL, Trans. Lit. and Phil. Soc. N. Y., 1815, 479, New York.
*Raia quadriloba*, LE SUEUR, Jour. Ac. Nat. Sci. Phila., I, 44, 1817, New Jersey.
*Rhinoptera quadriloba*, GÜNTHER, Cat., VIII, 494, 1870.
*Rhinoptera quadriloba*, DUMÉRIL, Elasmobranches, 648, 1870; JORDAN & GILBERT, Synopsis, 51, 1883.

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* "He enters the bay and ranges very extensively on the flats where the soft clam lives. These shellfish he is supposed to devour, for a shoal of cow-noses root up the salt-water flats as completely as a drove of hogs would do."—*Mitchill.*

### 136. RHINOPTERA STEINDACHNERI, Evermann & Jenkins.

(Gabilan.)

Width of disk 1¾ times its length; anterior border nearly straight; tail very slender, 1⅛ to 1⅓ times length of disk; muzzle emarginate; cephalic fin a little broader than head; tail with 1 or 2 serrated spines, their length 2½ times eye. Skin everywhere smooth. Teeth in lower jaw in 7 series, 7 in the median series, 6 in each of the others. Median teeth hexagonal, their length 3⅔ in the breadth, which is nearly twice the breadth of a tooth in the second series; this is again nearly twice as wide as teeth in third series; upper teeth very similar to lower. Uniform dark brown above, paler below. Gulf of California. (Named for Dr. Franz Steindachner, director of the Museum at Vienna, one of the most accurate and conscientious workers in ichthyology.)

*Rhinoptera steindachneri*, Evermann & Jenkins, Proc. U. S. Nat. Mus., 1891, 130, pl. 1, fig. 1, Guaymas, Sonora, Mexico. (Type, No. 43235.)

### Subgenus MICROMESUS, Gill.

### 137. RHINOPTERA ENSENADÆ, Rosa Smith.

Teeth of lower jaw in 14 or 15 series, all small, unequal in size, the broadest being those of the sixth series from the left side, which are twice as broad as long. Known only from a lower jaw picked up on the beach at Ensenada, on Todos Santos Bay, in Lower California. (Smith.)

*Rhinoptera ensenadæ*, Rosa Smith (Mrs. C. H. Eigenmann), Proc. U. S. Nat. Mus., 1886, 220, Ensenada, Lower California. (Type, No. 37966.)

## Family XXVIII. MANTIDÆ.

(The Sea Devils.)

Rays of enormous size, with the disk broader than long and the pectoral fins not continued on the sides of the head, the anterior or cephalic portion being separate, developed as 2 long horn-like or ear-like appendages. Mouth wide, terminal or inferior. Teeth very small, flat or tubercular, in many series, those of the upper jaw sometimes wanting. Eyes lateral. Nostrils widely separated, their valves united, forming a flap as wide as the cleft of the mouth. Tail long and slender, whip-like, with a single dorsal fin at its base, and with or without a serrated spine. Ventral fins not emarginate. Skin more or less rough. Males without differentiated spines on the pectorals, the sexes similar. Ovoviviparous Genera 2; species about 7. Largest of all rays and among the largest of all fishes; found in the tropical seas. (Myliobatidæ, group Ceratopterina, Günther, Cat., viii, 496–498.)

*a.* Teeth in both jaws; mouth inferior. Aodon, 58.
*aa.* Teeth in lower jaw only; mouth terminal. Manta, 59.

### 58. AODON, Lacépède.

*Aodon*, Lacépède, Hist. Nat. Poiss., i, 300, 1798, (*massassa*, French name only).
*Aodon*, Rafinesque, Indice, 46, 1810.
*Mobula*, Rafinesque, Indice d'Ittiol. Sicil., 61, 1810, (*auriculata* = *edentula*).
*Apterurus*, Rafinesque, *l. c.*, 62, (*fabroni* = *edentulus*).

*Cephalopterus*, (DUMÉRIL) RISSO, Ichthyol. Nice, 14, 1810, (*giorna* = *edentula*; not of Geoffroy St. Hilaire, 1809, a genus of birds).

*Dicerobatus*, BLAINVILLE, Jour. de Phys., 1816, 262, (*mobular* = *edentula*).

*Cephaloptera*, (DUMÉRIL) CUVIER, Règne Animal, Ed. 1, II, 138, 1817, (*giorna*).

*Aodon*, LACÉPÈDE, Hist. Nat. Poiss., Edition Pillot, II, 55, 1830, (*massassa*).

*Pterocephala*, SWAINSON, Nat. Hist. Fishes, II, 321, 1839, (*giorna*).

Head free from pectoral fin, truncated in front, with the cephalic fin on each side developed as a straight, horn-like appendage pointing forward. Nostrils widely separated. Mouth inferior, wide. Teeth in both jaws very small, flat, or tubercular, in many series. Tail very slender, with a dorsal fin between the ventrals; the serrated spine present or absent. Species about 5, in tropical seas, reaching an enormous size and therefore not well known. (*ἀ*—, without; *ὀδούς*, tooth; *Mobular* is a name said to be used for the European species, *Aodon edentulus* (Brünnich), in the Azores, "diable des Caraïbes.")

### 138. AODON HYPOSTOMUS, (Bancroft).

Skin smooth; mouth inferior; anterior margin of pectoral straight; the spiracles situated in a groove under anterior base of pectoral fin.

This species, described from Jamaica, is very imperfectly known, and may be the same as *Aodon olfersi* (Müller & Henle), afterward described from Brazil. (*ὑπό*, below; *στόμα*, mouth.)

*Cephalopterus hypostomus*, BANCROFT, Proc. Comm. Zoöl. Soc., 1830, 134, Jamaica.

## 59. MANTA, Bancroft.

*Manta*, BANCROFT, Zoöl. Jour., 1828–1829, IV, 444, (*manta* = *birostris*).

*Ceratoptera*, MÜLLER & HENLE, Plagiostomen, 186, 1838, (*vampyrus* = *birostris*).

*Brachioptilon*, NEWMAN, Zoölogist, 1849, 74, (*hamiltoni* = *birostris*).

*Diabolichthys*, HOLMES, Proc. Elliott Soc. Nat. Hist., 1856, 39, (*elliotti* = *birostris*).

Disk broader than long, its exterior angles acute, the posterior margins of the pectorals concave. Head truncate in front; the cephalic fins long, turned forward and inward. Mouth large, terminal. Teeth minute, present in lower jaw only. Tail whip-like, often (always?) without serrated spine. Skin rough, with small tubercles. Two species known. (*manta*, blanket, "a name used at the pearl fisheries between Panama and Guayaquil to designate an enormous fish much dreaded by the divers, whom it is said to devour after enveloping them in its vast wings." Duméril.)

### 139. MANTA BIROSTRIS, (Walbaum).

(SEA DEVIL; DEVIL FISH; MANTA.)

Disk not quite twice as broad as long. Tail about as long as the disk. Teeth in about 100 longitudinal series, which are separated by distinct interspaces. Skin of body and tail everywhere covered with small stellate tubercles, rendering the surface very rough. Brownish, the margins of the disk darker. Tropical waters of America; north to New Jersey and San Diego; not rare on the Florida coast. Reaches a width of about 20 feet, one of the most enormous of aquatic vertebrates. (*bis*, two; *rostrum*, snout.)

*Raia birostris*, WALBAUM, Artedi Piscium, 535, 1792, after *Diabolus marinus* Willughby, etc.

*Raia manatia*, BLOCH & SCHNEIDER, Syst. Ichth., 364, 1801, Tropical America; after *Raie manatie*, Lacépède.

*Raja diabolus marinus*, BLOCH & SCHNEIDER, *l. c.*, 368, 1801, India; after Willughby.

*Raia fimbriata*, LACÉPÈDE, Hist. Nat. Poiss., IV, 677, 1803, Gulf Stream, 58° N.

*Cephaloptera vampyrus*, MITCHILL, Ann. Lyc. Nat. Hist. N. Y., 1823, 23, Delaware Bay.

*Ceratoptera vampyrus*, DUMÉRIL, Elasmobranches, I, 660, 1870.

*Ceratoptera vampyrus*, GÜNTHER, Cat., VIII, 498, 1870.

*Cephalopterus giorna*, LE SUEUR, Jour. Ac. Nat. Sci. Phila., IV, 1824, 115, Georgia; (not *Raja giorna*, Lacépède).

*Cephaloptera manta*, or *Manta americana*, BANCROFT, Zoöl. Journal, IV, 144, 1828, Jamaica.

*Cephaloptera johni*, MÜLLER & HENLE, Plagiostomen, 186, 1838, West Indies.

*Brachioptilon hamiltoni*, NEWMAN, Zoöl., 74, 1849, Gulf of California.

*Diabolichthys elliotti*, HOLMES, Proc. Elliott Soc. Nat. Hist., 1856, 39, Charleston.

*Manta birostris*, JORDAN & GILBERT, Synopsis, 52, 1883.

## Subclass HOLOCEPHALI.

### (THE CHIMÆRAS.)

Skeleton cartilaginous. Gill cavity with 4 clefts within, but having one external opening only, which is covered by a fold of skin. No spiracles. Mouth inferior. Jaws with teeth, confluent into bony plates; upper jaw, palate, and hyomandibular coalescent with the skull; intestine with a spiral valve. Pectoral fins normally developed, placed low; ventral fins abdominal, with claspers in the male. Derivative radii sessile on the sides of the basal bones of the limbs. Skin scaleless, its muciferous system well developed. This group contains a single order, CHIMÆROIDEI. (HOLOCEPHALA, Cat., Günther, VIII, 348–352.) (*ὅλος*, solid; *κεφαλή*, head).

## Order H. CHIMÆROIDEI.

### (THE CHIMÆROIDS.)

Characters of the order included above. The group includes one existing family, CHIMÆRIDÆ. (*χίμαιρα*, chimæra; *εἶδος*, resemblance.)

## Family XXIX. CHIMÆRIDÆ.

### (THE CHIMÆRAS.)

Body elongate, rather robust anteriorly, tapering posteriorly. Head compressed; mouth small, inferior, the upper lip deeply notched. Nostrils confluent with the mouth, separated by a narrow isthmus; jaws with the teeth confluent into 4 bony laminæ above and 2 below. No spiracles. Pectoral fins free, placed low; ventral fins abdominal, many-rayed, provided in the male with claspers; dorsal fin usually divided, anteriorly with a very strong spine, which is grooved behind; caudal fin low, fold-like. Skin naked, rarely somewhat prickly. Lateral line present, usually with numerous branches anteriorly. Three free gills and 2 half gills, 1 on each side; isthmus moderate; gill rakers small. Oviparous, the egg cases long, elliptical, with silky filaments. Genera 4, (the following and *Callorhynchus*); species about 7. Fishes of singular appearance, found only in the seas of the cold regions. Numerous extinct genera are also referred to this family. (CHIMÆRIDÆ, Günther, Cat., VIII, 349-352).

CHIMÆRINÆ:

*a.* Snout short, soft, not terminating in a cutaneous flap; tail not bent upward.
  *b.* Claspers in the male trifid; tail ending in a filament. CHIMÆRA, 60.
  *bb.* Claspers in the male bifid; tail not ending in a filament. HYDROLAGUS, 61.

HARRIOTTINÆ:

*aa.* Snout excessively long, with leaf-like lateral expansions; dorsal spine very large; claspers small, simple. HARRIOTTA, 62.

## 60. CHIMÆRA, Linnæus.

### (ELEPHANT FISHES.)

*Chimæra*, LINNÆUS, Syst. Nat., Ed. x, 1758, 236, (*monstrosa*).

Head somewhat compressed, the snout bluntish, protruding, fleshy, not armed at tip with an appendage. Eyes very large, lateral. Teeth rather strong. Lips thickish, the lower with a frenum. Lateral line simple on the body, but forking anteriorly, forming several series of mucous tubes on the head. Male with a club-shaped cartilaginous hook on the head above the snout; this hook is curved forward and downward, and is armed at its tip with decurved spines; its tip fitting into a depression in front of the eyes; females without this appendage. Gill opening small. Pectorals moderate; ventrals rather large, with large bifid claspers in the male; male also with rough appendages at the base of the ventrals, protruding from a sheath of skin. First dorsal triangular, preceded by a strong spine, which is grooved behind and serrated on its edges; second dorsal and caudal fins low, often more or less notched. Tail extending in the line of the axis of the body, more or less produced in a filament at tip. Skin smooth. Fishes of singular appearance; mostly of the northern seas; not valued for food. (*Χίμαιρα*, chimæra, a fabulous monster, with the head of a lion, body of a goat, and tail of a serpent).

*a.* First dorsal almost continuous with second; body stout; pectorals reaching posterior end of ventrals. MONSTROSA, 140.

*aa.* First dorsal well separated from second; body slender; pectorals not nearly reaching ventrals. AFFINIS, 141.

### 140. CHIMÆRA MONSTROSA, Linnæus.

### (CHIMÆRA.)

Tail ending in a very long rayless filament about as long as body and head. First dorsal fin close to second and subcontinuous with it, the upper margin even, not notched except just in front of the low caudal fin; pectoral reaching posterior extremity of ventrals. Each clasper of the male with 2 long slender branches, each rather longer than snout, the inner branch again divided into a simply cartilaginous styliform part, and another coated with spiny membrane. Brown, marbled with lighter; dorsal fins with a broad black margin. (Günther.) Deep waters off the coast of Europe; recorded by Poey at Matanzas, Cuba. (*monstrosus*, monstrous.) (EU.)

*Chimæra monstrosa*, Linnæus, Syst. Nat., Ed. x, 1758, 236, Atlantic.
*Chimæra monstrosa*, Günther, Cat., viii, 349, 1870; Poey, Synopsis, 445, 1868.
*Chimæra argentea*, Ascanius Icones, Rev. Nat., pl. xv, 1806.
*Chimæra borealis*, Shaw, Gen. Zoöl., v, 2, 365, pl. 157, 1804, after Linnæus.
*Chimæra mediterranea*, Risso, Eur. Merid., iii, 168, 1827, Nice.
*Chimæra cristata*, Faber, Fische Islands, 45, 1829, Iceland.
*Callorhynchus centrina* and *C. atlanticus*, Gronow, Cat. Fishes, 15, 16, 1854, Atlantic.

### 141. CHIMÆRA AFFINIS, Capello.

Body more elongate than in *C. monstrosa;* base of first dorsal equal to interspace between them; second dorsal low, with a straight border; pectoral not nearly reaching ventrals; caudal very small, ending in a minute filament; cephalic appendages with 5 spines on the inner surface; claspers in male trifid, the division of the 3 portions at ⅔ the length from the base, the cylindrical portion larger, different in form from the others. (Capello.) L. 3 feet. Deep waters of the Atlantic, off Portugal and off the American Coast from Cape Cod northward. (*affinis*, related to *Chimæra monstrosa.)* (Eu.)

*Chimæra affinis*, Capello, Jour. Soc. Math. Lisbon, iv, 1868, 314, pl. iii, Coast of Portugal; Günther, Cat., viii, 350, 1870.
*Chimæra plumbea*, Gill, Proc. Philos. Soc. Wash., Dec. 22, 1877, Gulf stream off Cape Cod.
*Chimæra plumbea*, Jordan & Gilbert, Synopsis, 54, 1883.
*Chimæra abbreviata*, Gill, Proc. U. S. Nat. Mus., 1883, 254, Lat. 40° N., Long. 60° W. (Type, No. 33435.)

## 61. HYDROLAGUS, Gill.

*Hydrolagus*, Gill, Proc. Ac. Nat. Sci. Phila., 1862, 331, (*colliei*).

This genus is very close to *Chimæra*, differing chiefly in the form of its claspers, which are simply bifid, the 2 parts subequal. The tail is not produced in a filament. The single species lives in the North Pacific, in water of moderate depth. (*ὕδωρ*, water; *λαγώς*, hare, from the form of the lips and teeth.)

### 142. HYDROLAGUS COLLIEI, (Lay & Bennett).

(Ratfish; Elephant Fish.)

Body anteriorly stoutish, tapering into a slender tail, which is not produced in a filament. Pectorals about as long as head, reaching about to base of ventrals. Dorsal spine ¾ the length of the head. Second dorsal low, highest in front, then very low, then higher, ending abruptly just before the beginning of the upper caudal fold; a small fold between first and second dorsal, free from both; lower caudal fold higher than upper, neither quite reaching the tip of the tail. No distinct anal fin. Color grayish, with numerous round white spots; both dorsals edged with blackish. L. 2 feet. Pacific coast from Monterey northward to Alaska; very abundant in cold waters at a moderate depth; rarely used as food. (A personal name).

*Chimæra colliei*, Lay & Bennett, Beechey's Voy., Zoöl., 71, 1849, North Pacific; Günther, Cat., viii, 350, 1870; Jordan & Gilbert, Synopsis, 55, 1883.

## 62. HARRIOTTA, Goode & Bean.

*Harriotta*, GOODE & BEAN, Oceanic Ichthyology, 32, 1894, (*raleighana*).

Snout exceedingly elongate, with a cartilaginous midrib, and foliaceous lateral expansions of the skin at its base. Two dorsal fins, the anterior with an immense triangular spine, finely serrated upon its lateral edges. Anal fin reduced to a cutaneous fold. Longitudinal axis of the tail nearly the same as that of the trunk, very elongate, with filamentous tip, the fin below much more extensive than that above. No cephalic organ. Gill openings lateral, separated by a wide isthmus. Claspers small and simple. ("Named in honor of Thomas Harriott, the most eminent philosopher and naturalist of his day in England, who was a member of Raleigh's Roanoke colony in Virginia in 1585, and who published the first work in English on American natural history.")

### 143. HARRIOTTA RALEIGHANA, Goode & Bean.

Tail extended in a very long filament, much longer in the older individuals than in the young; not present in very young. First dorsal fin separated from the second by an interval nearly equal to the diameter of the eye in the older individuals, very much greater in the younger ones, in which the cartilaginous portion is exceedingly narrow and high; Second dorsal fin long and low, its height about equal to diameter of the eye, its length equal to that of head. Dorsal spine very strong; its length in the older individuals equal to the distance from its own base to the origin of the second dorsal; in the young it is proportionately much longer and stouter; a double row of strong spines in advance of the second dorsal, and in the notch between the second dorsal and its continuation upon the upper part of the tail; a similar group of at least 6 strong spines upon the top of the head back of the interorbital space, and surrounded by the curve of the forward extension of the lateral line. Traces of these spines may be felt beneath the skin in older individuals of both sexes. Claspers in the young male examined, small and simple, in length scarcely equal to $\frac{2}{3}$ the long diameter of the eye. Pectoral fins immense, wing-like, rounded in the young, subfalcate in the older individuals; inserted slightly in advance of the origin of the first dorsal, and extending in the older forms beyond the root of the ventral. Ventrals also subfalcate; similar in form and appearance to the pectoral, and extending to a point at $\frac{2}{3}$ the distance from the origin to the end of the second dorsal; in length little less than $\frac{1}{2}$ the snout. In the young the ventrals are placed somewhat farther back and reach to a point under the origin of the third section of the dorsal fin. Tail prolonged in a slender filament, and in the older individuals the cutaneous flap upon its lower edge is 3 or 4 times as deep as that above, and extends beyond it anteriorly and posteriorly. In the younger specimens the upper and lower flaps are about equal in height, and the upper flap extends far in advance of the insertion of the lower one. Lateral line extending in a straight line from a point beneath the origin of the first dorsal approximately to the middle of the lower caudal lobe, which it follows along its base for the remainder of its course; in advance of the dorsal fin it bends downward in an elliptical course, and then rises vertically from the occiput to join its counterpart from the other side; bridle-like extensions of the same system extend on the sides of the head under the eyes, curving upward in front of the eye, then downward and joining on the underside of the snout to a branch running from beneath the eye downward to the base of the pectoral in the young, or under the throat to a junction in the older ones, and also forward from the same point under the eyes to join on either side the circle which surrounds the mouth. An elaborate system of mucous pores upon all sides of the snout; on the under surface of the snout in 4 longitudinal series. In the older individuals there is an extension of the lateral line system on either side of the midrib on the snout to its tip, and there are also symmetrical continuations of the same upon the under surface of the snout. Color brown; caudal filament pale. Eye 5½ in snout in the older specimens, and the distance between the eyes is equal to their diameter. Four specimens known, the largest, a female (No. 39415, U. S. N. M.), 25 inches in length, from 39° 44′ 30″ N. lat., 70° 30′ 45″ W. long., in 1,081 fathoms, taken by the steamer *Albatross*. Another, a male (No. 38200, U. S. N. M.), 19½ inches in length, was taken by the *Albatross* in 36° 45′ N. lat., 74° 28′ 30″ W. long., at a depth of 781 fathoms. A third, a young individual (No. 35520, U. S. N. M.), 4 inches in length, was obtained by the *Albatross* in 39° 37′ 45″ N. lat., 71° 18′ 45″ W. long., in 991 fathoms. Still another (No. 35631), was taken at station 2235, lat. 39° 12′, long. 72° 03′ 30″, 707 fathoms. (Goode & Bean.) (Named in honor of Sir Walter Raleigh, by whom the first English scientific explorer was sent to the New World.)

*Harriotta raleighana*, Goode & Bean, Oceanic Ichthyology, 33, 1894, 39° N., 70° W.

With this extraordinary creature we close the Selachian series and take up the group of Ganoids, from which stock the true fishes of the present day, as well as all the higher vertebrates, seem to be descended. The old Ganoids were doubtless largely amphibious. The group has apparently early differentiated into the lung-bearing series, from which the two orders of the *Dipnoi* and the *Batrachia* are descended, and the aquatic series, in which the lung becomes degraded to a swim bladder, the last being the ancestors of the true fishes.

## Subclass TELEOSTOMI.

### (The True Fishes.)

Skeleton usually bony, sometimes cartilaginous. Skull with sutures; membrane bones (opercle, preopercle, etc.) present; gill openings a single slit on each side; gills with their outer edges free, their bases attached to bony arches, normally 4 pairs of these, the fifth pair being typically modified into tooth-bearing lower pharyngeals; median and paired fins developed, the latter with distinct rays. Ova small; no claspers. Heart developed, divided into an auricle, ventricle, and arterial bulb. Lungs imperfectly developed or degraded to form a swim bladder, or entirely absent.

We here include under one head the GANOIDS and the TELEOSTS. The former group is chiefly composed of extinct forms. While many of its representatives are extremely dissimilar to the bony fishes, there is a gradual series of transitions, and between the CYCLOGANOIDEA of the GANOIDS and the CLUPEOIDS and others of the true TELEOSTS, the resemblance is much greater than that between the CYCLOGANOIDEA and many other GANOIDS. The GANOIDS are, in fact, the most generalized of the true fishes, those nearest the stock from which the TELEOSTS on the one hand, and the DIPNOI and BATRACHIA on the other, have sprung. The real value or rank of some of the current orders or suborders is still doubtful. (*τέλειος*, perfect; *στόμα*, mouth.)

Omitting orders not represented in our waters, we have the following analysis of—

## ORDERS OF TRUE FISHES.

*a.* Arterial bulb muscular with numerous valves; optic nerves forming a solid chiasma; ventrals abdominal; air bladder with a well developed duct; tail strongly heterocercal throughout life; some fins usually with fulcra. (Series *Ganoidei.*)

CHONDROGANOIDEA:

*b.* Skeleton cartilaginous; ventrals with an entire series of basilar segments.

*c.* Maxillary and interopercle obsolete; skin naked; air bladder cellular. SELACHOSTOMI, I.

*cc.* Maxillary and interopercle present; skin with bony shields; air bladder simple. CHONDROSTEI, J.

HOLOSTEI OR HYOGANOIDEA:

*bb.* Skeleton bony; ventrals with basilar segments rudimentary; air bladder cellular.

*d.* Vertebræ opisthocœlian (concavo-convex); maxillary transversely divided into several pieces; scales rhombic, enameled plates. RHOMBOGANOIDEA, K.

*dd.* Vertebræ amphicœlian (double concave); maxillary not transversely divided; scales cycloid. CYCLOGANOIDEA, L.

*aa.* Arterial bulb thin, with a pair of opposite valves; optic nerves crossing, not forming a solid chiasma. (Series *Teleostei.*)

*e.* Anterior vertebræ (about 4), much modified, coössified and provided with ossicula auditus, or weberian apparatus; shoulder girdle suspended from the skull by a bony post-temporal; mesocoracoid arch well developed. Air bladder (if present) connected by a slender air duct with the intestinal canal, this persistent throughout life; ventral fins (if present) abdominal, without spines, their basilar segments rudimental. (OSTARIOPHYSI.)

*f.* Maxillary bone imperfect, forming the base of a conspicuous barbel; no subopercle nor symplectic bone; no scales; supraoccipital and parietals coössified. NEMATOGNATHI, M.

*ff.* Maxillary bone perfect (rarely wanting) and never entering into the base of a barbel; subopercle and symplectic present; scales usually present. PLECTOSPONDYLI, N.

*ee.* Anterior vertebræ unmodified, similar to the others, or more elongate; separate and without ossicula auditus. (Descendants of Holostean Ganoids.)

*g.* Body eel-shaped, provided with very many (100 to 250) vertebræ; scales minute or wanting; no ventral fins; gill openings restricted.

*h.* Gill arches 4 pairs; the hindmost being modified as pharyngeal bones; palatopterygoid arch present.

*i.* Premaxillary, maxillary, and palatine bones well developed and distinct from each other as in ordinary fishes; no paired fins; gill openings confluent; shoulder girdle joined to the cranium in our species (but not in all). SYMBRANCHIA, O.

- *ii.* Premaxillaries and maxillaries present, united by suture and immovably connected to the cranium; otherwise as in *Apodes*. CARENCHELI, P.
- *iii.* Premaxillary atrophied or lost; maxillaries lateral, more or less confluent with the palatines; shoulder girdle not attached to the skull. APODES, Q.

*hh.* Gill arches 5 or 6 pairs; the posterior not modified into pharyngeals, and all of them, as well as the shoulder girdle, disconnected from the cranium; no palatopterygoid arch; no opercular elements. LYOMERI, R.

*gg.* Body not truly eel-shaped; the vertebræ usually in moderate or rather large number (14 to 150); ventral fins usually present; gill openings typically ample; premaxillary always present, and maxillary usually so; shoulder girdle near the cranium, usually but not always attached to it.

- *j.* Hypercoracoid and hypocoracoid coalesced in a single lamellar imperforate plate; scapular arch formed of proscapula and posttemporal, the latter impinging on supraoccipital only; dorsal fin with many spines. HETEROMI, V.
- *jj.* Hypercoracoid and hypocoracoid imperfectly differentiated, represented by a cartilaginous strip or plate, not perforate, and without separate actinosts; ventrals abdominal; no fin spines. XENOMI, W.
- *jjj.* Hypercoracoid and hypocoracoid well developed, not coalescent.
  - *k.* Interclavicles present; air bladder without duct; ventrals abdominal or subabdominal, if present; no mesocoracoid.
    - *l.* Gills pectinate; gill openings large; dorsal and ventral usually with spines. HEMIBRANCHII, Z.
    - *ll.* Gills tufted; gill openings very small; opercle a simple plate; skin with bony plates. LOPHOBRANCHII, AA.
  - *kk.* Interclavicles wanting, so far as known.
    - *m.* Preopercle entirely detached from the suspensorium, rudimentary and attached only to lower jaw, its normal position taken by the subopercle; no spines; no mesocoracoid. LYOPOMI, U.
    - *mm.* Preopercle normally connected.
      - *n.* Mesocoracoid well developed; fins without spines; air bladder with a persistent duct; pectoral fins inserted low; ventrals abdominal. ISOSPONDYLI, S.
      - *nn.* Mesocoracoid always wanting.
        - *o.* Ventral fins abdominal, without spines; no true spines in dorsal or anal fins.
          - *p.* Air bladder with a persistent duct; lower pharyngeals separate.
            - *q.* Shoulder girdle not connected with the skull in the usual way, the post-temporal barely touching the cranium. (Mostly deep-sea fishes, with weak skeletons.) INIOMI, T.
            - *qq.* Shoulder girdle connected with the skull by a bifid post-temporal. (Mostly fresh-water fishes, the skeleton well ossified.) HAPLOMI, X.
          - *pp.* Air bladder without duct in adult; lower pharyngeals fully united. SYNENTOGNATHI, Y.
        - *oo.* Ventral fins usually anterior in position; spines usually present in the fins; pectoral fins not on the plane of the abdomen; parietal bones usually separated by the supraoccipital. (Spiny-rayed fishes chiefly.)
          - *r.* Pectoral fins not pediculate, the gill openings in front of them. ACANTHOPTERI, BB.
          - *rr.* Pectoral fins pediculate, the basal bones reduced in number and elongate; gills in the axil of the pectorals. PEDICULATI, CC.

## Series GANOIDEI.

### (The Ganoid Fishes.)

The name Ganoidei was first used by Agassiz, for those fishes which are armed with bony plates, instead of regular cycloid or ctenoid scales. Later, Johannes Müller restricted the group to those fishes thought to show more or less distinct reptilian or batrachian affinities, and especially, affinities with the mailed fishes of the Devonian and Carboniferous ages. The group is a heterogeneous one, and one practically scarcely susceptible of definition. In some of the Ganoids, the air bladder still retains its original function, a lung. The existence of the solid optic chiasma, the presence of several valves in the arterial bulb, and of a more or less developed spiral valve in the rectum, distinguish the living Ganoids from all Teleosts, but none of these characters can be verified in the extinct forms. We begin the series with forms having the skeleton still cartilaginous as in the sharks, but even less developed. (*γάνος*, splendor, from the enameled scales.)

## CHONDROGANOIDEA.

### (The Cartilaginous Ganoids.)

Skeleton chiefly cartilaginous, the vertebral column entirely so, the vertebral segments little developed, arranged along the notochord. Anterior vertebræ simple, imperfectly formed. Ventral fins abdominal, with an entire series of basilar segments. No suboperculum or preoperculum. Branchiostegal single or wanting; a mesocoracoid arch; no symplectic bone. Mesopterygium distinct; interclavicles present.* Arterial bulb with several pairs of valves. Optic nerves forming a chiasma. Intestine with a spiral valve. Air bladder connected by a duct with the œsophagus. Tail heterocercal, its fin with fulcra. Skin naked or armed with bony plates, never with true scales. This group comprises two orders. Its place seems to be intermediate between the Sharks and the Catfishes, though without close relation to either. (Chondrostei, Günther, Cat., viii, 332-347.) (*χόνδρος*, cartilage; *Ganoidea.*)

#### Analysis of Orders of Chondroganoidea.

*a.* Maxillary and interopercle obsolete; skin naked; branchihyals cartilaginous; air bladder cellular. Selachostomi, I.

*aa.* Maxillary and interopercle present; skin with bony shields; branchihyals osseous; air bladder simple. Chondrostei, J.

## Order I. SELACHOSTOMI.

### (The Paddle-fishes.)

Notochord persistent, the division into vertebræ imperfect. Mesocoracoid developed; no symplectic bone; premaxillary forming border of mouth; no suboperculum, preoperculum, nor interoperculum; mesopterygium distinct; basihyals and superior ceratohyal not ossified; interclavicles present; maxillaries obsolete; branchihyals cartilaginous. This order contains but one family, POLYODONTIDÆ. (*σελάχη*, shark; *στόμα*, mouth.)

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* The osteological characters here and in some other parts of this work are partly taken from Cope's "Contribution to the Ichthyology of the Lesser Antilles," Trans. Am. Phil. Soc., 1870.

## Family XXX. POLYODONTIDÆ.

### (THE PADDLE-FISHES.)

Body fusiform, little compressed, covered with mostly smooth skin. Snout prolonged, expanded into a thin flat blade, the inner portion formed by the produced nasal bones, the outer portion with a reticulate bony framework, the whole somewhat flexible. Mouth broad, terminal, but overhung by the spatulate snout, its border formed by the premaxillaries, the maxillaries being obsolete; jaws with many fine deciduous teeth; similar teeth on palatines; no tongue. Spiracles present. Operculum rudimentary, its skin produced behind into a long acute flap; no pseudobranchiæ, or opercular gill; gills 4½; gill rakers long, in a double series on each arch, the series divided by a broad membrane; gill membranes considerably connected, free from the isthmus; a single broad branchiostegal. No barbels. Nostrils double at base of blade. Lateral line continuous, its lower margin with short branches. Dorsal fin well back, of soft rays only; anal similar, rather farther back; tail heterocercal, the lower caudal lobe well developed, so that the fin is nearly equally forked; sides of the bent portion of the tail armed with small rhombic plates; caudal fin with fulcra. Pectorals moderate, placed low; ventrals abdominal, many-rayed. Air bladder cellular, not bifid; pyloric cœca in the form of a short, broad, branching, leaf-like organ; intestine with a spiral valve. Two species known—*Polyodon spathula* and *Psephurus gladius;* singular fishes, inhabiting the fresh waters of the United States and China. They feed chiefly on mud and minute organisms contained in it, stirring it up with the spatulate snout. (POLYODONTIDÆ, Günther, Cat., VIII, 346–347.)

*a.* Gill rakers very fine and numerous; caudal fulcra small and numerous. POLYODON, 63.

## 63. POLYODON, Lacépède.

### (PADDLE-FISHES.)

*Polyodon*, LACÉPÈDE, Hist. Nat. Poiss., I, 402, 1798, (*feuille*); French name only.
*Polyodon*, BLOCH & SCHNEIDER, Syst. Ichth., 457, 1801, (*folium*).
*Spatularia*, SHAW, Gen. Zoöl., V, 362, 1804, (*reticulata*).
*Platirostra*, LE SUEUR, Jour. Ac. Nat. Sci. Phila., I, 1817, 227, (*edentula*).
*Planirostra*, RAFINESQUE, Ich. Oh., 83, 1820, (*edentula*).
*Proceros*, RAFINESQUE, Ich. Oh., 87, 1820, (*maculatus*).

Gill rakers exceedingly numerous, very slender; spatula broad. Caudal fulcra 13 to 20 in number, of moderate size. Characters otherwise those of the family. Rivers of the middle United States. (*πολύς*, many; *ὀδούς*, tooth.)

### 144. POLYODON SPATHULA, (Walbaum).

(PADDLE-FISH; SPOON-BILL CAT; DUCK-BILL CAT; SPADE-FISH.)

Opercular flap very long, nearly reaching to ventrals; premaxillary extending far behind the small eye. Skin smooth, or nearly so, except the rhombic plates on the sides of the tail. Ventrals near the middle of the body; dorsal well behind them; anal mostly behind the dorsal, and somewhat larger; these fins somewhat falcate. Fin rays slender. Spiracle with a minute barbel. Isthmus papillose in the young. Spatula broad, 2½ to 4 times in length, proportionately longer in young. Head, with opercular flap, more than ½ length; head, without spatula flap, about 5. Color pale olivaceous. D. 50 to 60; A. 50 to 65; V. 45. L. 5 to 6 feet. Mississippi Valley and rivers of the southern States; generally abundant in the larger streams; also known from Lake Erie. A singular fish of rather sluggish habits, the flesh coarse, resembling that of the larger catfishes, but inferior in quality. (*spathula*, spatula.)

*Squalus spathula*, WALBAUM, Artedi Pisc., 522, 1792, after *Spathula* of Rozier, Jour. Phys., 1774, 384, pl. 2.

"*Polyodon feuille*," LACÉPÈDE, Hist. Nat. Poiss., I, 402, 1798, locality unknown.

*Polyodon folium*, BLOCH & SCHNEIDER, Syst. Ichth., 457, 1801, after Lacépède.

*Spatularia reticulata*, SHAW, Gen. Zoöl., V, 362, 1804, after Lacépède.

*Platirostra edentula* (adult), LE SUEUR, Jour. Ac. Nat. Sci. Phila., I, 1817, 227, Ohio River.

*Polyodon folium*, GÜNTHER, Cat., VIII, 346, 1870.

*Polyodon spathula*, JORDAN & GILBERT, Synopsis, 83, 1883.

*Acipenser lagenarius*, RAFINESQUE, Ich. Oh., 86, 1820, Ohio River.

*Procerus maculatus*, St. Genevieve, Missouri, and *Proceros vittatus*, Lake Ontario, RAFINESQUE, Ich. Oh., 86, 87, 1820.

*Planirostra spatula*, OWEN, Osteol. Cat., I, 83, 1853.

## Order J. CHONDROSTEI.

### (THE STURGEONS.)

Notochord persistent, the cartilaginous vertebræ imperfectly developed. A mesocoracoid. No symplectic bone. Maxillary present. No suboperculum or preoperculum. Interoperculum present. Mesopterygium distinct. Interclavicles present. Basihyals and superior ceratohyal not ossified. Branchihyals osseous. This group is composed of the single family ACIPENSERIDÆ. (*χόνδρος*, cartilage; *ὀστέον*, bone.)

### Family XXXI. ACIPENSERIDÆ.

### (THE STURGEONS.)

Body elongate, subcylindrical, armed with 5 rows of bony bucklers, each with a median carina which terminates in a spine, which sometimes becomes obsolete with age; a median dorsal series, and a lateral and abdominal series on each side, the abdominal series sometimes deciduous; between these the skin is rough with small irregular plates. Head covered with bony plates joined by sutures; snout produced, depressed, conical, or subspatulate. Mouth small, inferior, protractile, with thickened lips. No teeth. Four barbels in a transverse series on the lower side of the snout in front of the mouth. Eyes small; nostrils large, double, in front of eye. Gills 4; an accessory opercular gill; gill membranes united to the isthmus; no branchiostegals. Maxillary distinct from the premaxillary. Head covered with bony plates united by sutures. Fin rays slender, all articulated; vertical fins with fulcra. Pectorals placed low; ventrals many-rayed, behind middle of body; dorsal placed posteriorly;

anal somewhat behind it, similar; tail heterocercal, the lower caudal lobe developed; the upper lobe of the tail covered with rhomboid scales. Air bladder large, simple, connected with the œsophagus. Pseudobranchiæ small or obsolete. Stomach without blind sac; rectum with a spiral valve; pancreas divided into pyloric appendages.

Large fishes of the seas and fresh waters of northern regions, feeding on small animals and plants sucked in through the tube-like mouth. Most of the species are migratory, like the salmon, which are found in the same waters. Genera 2; species about 20; although more than 5 times that number have been described. The American species especially have been unduly multiplied, particularly by Auguste Duméril, who has found upwards of 40 of them in the museum at Paris. But 6 American species are known to us, and we doubt if any more exist. The changes with age are considerable; the snout, in particular, becomes much shorter and less acute, and the roughness of the scales is greatly diminished; the ventral shields sometimes disappear altogether. The number of plates, although one of the best specific characters, is subject to considerable variation. (ACIPENSERIDÆ, Günther, Cat., VIII, 332-345.)

*a.* Spiracles present; snout subconic; rows of bony shields distinct throughout; the tail not depressed nor mailed; gill rakers lanceolate. ACIPENSER, 64.

*aa.* Spiracles obsolete; snout subspatulate; rows of bony shields confluent behind the dorsal so that the depressed tail is completely mailed; gill rakers small, fan-shaped, ending in 3 or 4 points. SCAPHIRHYNCHUS, 65.

## 64. ACIPENSER, Linnæus.

### (STURGEONS.)

*Acipenser*, (ARTEDI), LINNÆUS, Syst. Nat., Ed. x, 1758, 237, (*sturio*).
*Sturio*, RAFINESQUE, Indice Itt. Sicil., 41, 1810, (*sturio*).
*Sterletus*, RAFINESQUE, Ich. Oh., 79, 1820, (*serotinus*).
*Dinectus*, RAFINESQUE, *l. c.*, 82, (*truncatus*).
*Huso*, BRANDT & RATZEBURG, Medizin. Zoöl., II, 3, 1833, (*huso*).
*Sterletus*, BRANDT & RATZEBURG, *l. c.*, 3, (*ruthenus*).
*Helops*, BRANDT & RATZEBURG, *l. c.*, 3, (*stellatus*).
*Lioniscus*, FITZINGER & HECKEL, Ann. Wien. Mus., 370, 1836, (*glaber*).
*Antaceus*, BRANDT, Bull. Ac. Sci. Petersb., v, 138, 1865, (*schypa*).

Snout subconical, more or less depressed below the level of the forehead. A small spiracle over the eye. Caudal peduncle moderately long, deeper than broad, the rows of bony bucklers distinct to the base of the caudal fin. Tail not produced into a filament, its tip surrounded by the caudal rays. Gill rakers small, narrowed or lanceolate. Pseudobranchiæ present. Species numerous in all northern rivers and seas. (*acipenser*, sturgeon.)

*a.* Plates between ventrals and anal small, in 2 rows of 4 to 8; space between dorsal and lateral shields with stellate plates of moderate size, in about 5 rows, interspersed with smaller ones. Dorsal shields about 12; lateral about 45; ventral about 2. D. 47; A. 29. Color plain grayish. TRANSMONTANUS, 145.

*aa.* Plates between ventrals and anal large, in 1 row, or in 2 rows anteriorly and 1 posteriorly, of 1 to 4 plates each.

*b.* Space between dorsal and lateral shields with stellate plates of rather large size, in 5 to 10 series; last dorsal shield of moderate size, more than ½ length of one before it.

*c.* Shields all roughly striated and ridged; anal nearly as long as dorsal and almost entirely behind it. D. 33; A. 22. Dorsal shields about 9; lateral about 26; ventral about 8. Color decidedly greenish. MEDIROSTRIS, 146.

*cc.* Shields not roughly striated; anal a little more than ½ length of dorsal and almost entirely below it. D. 38; A. 27. Dorsal shields about 10; lateral 29; ventral 9. Color grayish. STURIO, 147.

*bb.* Space between dorsal and lateral shields with minute spinules in very many series.

*d.* Last dorsal shield of moderate size, more than ½ the one before it. Anal 1½ in dorsal and beginning below its middle. Dorsal shields about 15; lateral 38; ventral 10. D. 35; A. 37. RUBICUNDUS, 148.

*dd.* Last dorsal shield very small, less than ½ length of the one before it; dorsal shields 11; lateral 32; ventral 9. D. 41; A. 22. Anal entirely below dorsal and ½ as long. BREVIROSTRUM, 149.

### 145. ACIPENSER TRANSMONTANUS, Richardson.

(WHITE STURGEON; OREGON STURGEON; SACRAMENTO STURGEON.)

Color dark grayish, scarcely olive tinged, and without stripes. Dorsal shields mesocentrous, with a compressed bluntish spine, which is anteriorly often serrated, and followed behind by a compressed keel. Skin with stellate roughnesses, but smoother than in *A. medirostris.* Space between lateral shields with stellate plates of moderate size, in about 5 series interspersed with smaller ones; last dorsal shield ½ length of one before it. Snout sharp in the young, becoming rather blunt and short in the adult, when it is considerably shorter than the rest of the head. Barbels rather nearer to the tip of snout than to the mouth. Gill rakers comparatively long, more than 3 times as high as broad, about 26 in number. Upper lobe of tail with rhombic plates. First caudal fulcrum, above and below, enlarged and granular. Lower lobe of caudal rather sharp and long, not much shorter than upper. Dorsal plates 11 or 12; lateral 36 to 50, usually about 44; ventral 10 to 12. Anal fin below dorsal, its base about ½ as long. D. 45 (44 to 48); A. 28 to 30. Depth 7 in length; head 4. Pacific coast from Alaska south to Monterey, ascending the Sacramento, Columbia, and Fraser rivers in large numbers in spring. It reaches a weight of 300 to 600 pounds, and is largely used as food, but is rather coarse. (*transmontanus*, beyond mountains.)

*Acipenser transmontanus*, RICHARDSON, Fauna Bor. Amer., III, 278, 1836; Fort Vancouver.

*Acipenser brachyrhynchus*, and *acutirostris* (young), AYRES, Proc. Cal. Ac. Sci., 1854, 15, 16, San Francisco.

*Acipenser transmontanus* and *brachyrhynchus*, GÜNTHER, Cat., VIII, 336, 337, 1870.

*Acipenser transmontanus*, JORDAN & GILBERT, Synopsis, 86, 1883.

? *Acipenser aleutensis*, FITZINGER & HECKEL, Ann. Wien. Mus., 1836, Aleutian Islands, after Pallas.

*Acipenser caryi*, *ayresi*, and *putnami*, DUMÉRIL, Nouv. Arch. Mus., III, 169, 171, 178, 1867, San Francisco.

*Acipenser transmontanus*, KIRSCH & FORDICE,* Proc. Ac. Nat. Sci. Phila., 1889, 254.

### 146. ACIPENSER MEDIROSTRIS, Ayres.

(GREEN STURGEON.)

Color olive-green, with an olive stripe on the median line of the belly and one on each side above the ventral plates, these stripes ceasing opposite the vent. Shields generally opisthocentrous with a strongly hooked spine; the surface very rough. Space between lateral and dorsal rows of shields with about 5 series of stellate plates interspersed with smaller ones; last dorsal shield moderate; more than ½ the one before it. Snout about as in *A. transmontanus*, sharp in the young, becoming blunt with age, usually rather shorter than the rest of head. Barbels nearly midway between tip of snout and mouth. Gill rakers scarcely higher than broad, about 17 in number. Upper lobe of tail with some scattered plates. Caudal fulcra not enlarged. Lower lobe of caudal short and blunt, little more than ½ the length of the upper. Dorsal plates 10 (9 to 11); lateral 26 to 30; ventral 9 (7 to 10). Anal nearly as long as dorsal and mostly behind it. D. 33 to 35; A. 22 to 28. Depth 7½ in length; head 4½. Pacific coast, ascending the rivers from San Francisco northward, reaching a large size; less abundant than *A. transmontanus*, and smaller in size; not used for food, being reputed poisonous. (*medium*, moderate; *rostrum*, snout.)

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* This paper contains descriptions and synonymy of all the American Sturgeons.

*Acipenser medirostris*, Ayres, Proc. Cal. Ac. Sci., I, 15, 1854, San Francisco; Günther, Cat., VIII, 342, 1870; Jordan & Gilbert, Synopsis, 86, 1883.

*Acipenser agassizii*, *alexandri*, and *oligopeltis*, Duméril, Nouv. Arch. Mus., III, 181, 183, 184, 1867, San Francisco.

*Acipenser agassizi*, Günther, Cat., VIII, 344, 1870.

*Acipenser acutirostris*, Günther, Cat., VIII, 344, 1870.

*Acipenser medirostris*, Kirsch & Fordice, *l. c.*, 249, 1889.

### 147. ACIPENSER STURIO, Linnæus.

(Common Sturgeon.)

Shields not strongly striated; stellate plates small, in about 10 rows, with smaller ones interspersed; last dorsal shield moderate, more than ½ length of one before it. Snout rather sharp, nearly as long as the rest of the head, becoming comparatively shorter and blunter with age. Barbels nearly midway between mouth and tip of snout, shortish, not reaching the mouth. Gill rakers small, slender, pointed, sparse, not longer than the pupil. Fulcra roughish, not enlarged. Lower lobe of tail rather sharp. Anal more than ½ dorsal, placed mostly below it. Anterior rays of pectoral thickened. D. 38; A. 27. Dorsal plates 10 to 14; lateral 29 (27 to 36); ventral plates 9 (8 to 11). Olive gray, paler below. Atlantic coasts; ascending rivers of northern Europe and the United States.

The American Sturgeon (var. *oxyrhynchus*, Mitchill) has the number of lateral plates generally fewer (27 to 29 instead of 29 to 36, as in European examples). The stellate ossifications are also said to be somewhat rougher than in the European form. New England to Carolina; abundant. (*sturio*, sturgeon.) (Eu.)

*Acipenser sturio*, Linnæus, Syst. Nat., x, 1758, 237; Günther, Cat., VIII, 342, 1870.

*Acipenser oxyrhynchus*, Mitchill, Trans. Lit. & Phil. Soc. N. Y., 1, 462, 1814, the American form, New York; Jordan & Gilbert, Synopsis, 86, 1883.

*Sturio vulgaris*, Rafinesque, Indice, 41, 1810, Palermo.

*Acipenser lichtensteini*, *latirostris*, *hospitus*, *thompsoni*, *attilus*, and *yarrelli* of European authors; *A. mitchilli*, New York; *kennicotti*, James River; *girardi*, Maryland; *macrorhinus*, New York; *megalaspis*, Lake Champlain, *milberti*, New York, *bairdi*, Maryland; *storeri*, Boston; *holbrooki*, Charleston; and *lecontei*, New York; Duméril, Nouv. Arch. Mus., III, 1867.

### 148. ACIPENSER RUBICUNDUS, Le Sueur.

(Lake Sturgeon; Ohio Sturgeon; Stone Sturgeon; Rock Sturgeon; Red Sturgeon.)

Dark olive above, sides paler or reddish, often with irregular blackish spots. Body comparatively elongate; snout slender and long in the young, becoming quite blunt with age, when it is considerably shorter than the rest of the head; shields large, rough, with strongly hooked spines, becoming later comparatively smooth, the old examples almost smooth. Skin with minute rough spinules in many series; ventral shields growing smaller with age, and finally deciduous; last dorsal shield of moderate size, about ½ length of next the last. Anal ⅔ length of dorsal, beginning near its middle. Dorsal shields 15 (11 to 16); lateral shields 38 (30 to 39); ventral plates 10 (8 to 11). D. 35; A. 26. L. 6 feet. Weight 50 to 100 pounds. Mississippi Valley, Great Lakes, and northward; the common fresh-water sturgeon of the lakes and streams of the middle west, usually not descending to the sea. The small rough "Rock Sturgeon," *A. maculosus*, Le Sueur, we regard as the young of this species. (*rubicundus*, reddish.)

*Acipenser rubicundus*, Le Sueur, Trans. Amer. Phil. Soc., I, 1818, 388, Lakes Ontario, Erie, and all the upper Lakes.

*Acipenser maculosus*, Le Sueur, *l. c.*, I, 393, 1818, (young), Ohio River.

*Acipenser rupertianus*, Richabdson, Fauna Bor. Amer., III, 11, 1836, Albany River, Rupert Land.

*Acipenser lævis*, *carbonarius*, and *rhynchæus*, Agassiz, 267, 271, 276, 1850, Lake Superior.

*Acipenser rubicundus* and *maculosus*, Günther, Cat., VIII, 338, 339, 1870.

*Acipenser liopeltis*, Günther, Cat., VIII, 341, 1870, Mississippi.

*Acipenser rubicundus*, Milner, Rept. U. S. Fish Com., 1872, 1873, 67.

*Acipenser rubicundus*, Jordan & Gilbert, Synopsis, 87, 1883.

*Acipenser serotinus*, *ohiensis*, and *macrostomus*, Rafinesque, Ich. Oh., 80, 1820, Ohio River.

*Dinectus truncatus*, Rafinesque, Ich. Oh., 80, 81, 1820, (erroneous, on a drawing by Audubon).

*Acipenser copei*, ? upper Missouri; *rauchi*, Osage River; *richardsoni*, Missouri River; *anasimos*, Missouri River; *paranasimos*, Huntsville, Ala.; *anthracinus*, Lake Erie; *lamarii*, Mississippi River; *atelaspis*, Saskatchewan River; *rafinesquei*, Ohio River; *rosarium*, upper Mississippi, or Lake Erie; *platyrhinus*, upper Mississippi or Lake Erie; *kirtlandi*, Lake Erie; *nertinianus*, Michigan; *honneymani*, no locality; *cincinnati*, Ohio River; and *buffalo*, Lake Erie; Duméril, Hist. Poiss., II, 108–231, 1870.

### 149. ACIPENSER BREVIROSTRUM, Le Sueur.

(Shortnosed Sturgeon.)

Dusky above, paler below. Snout very short and obtuse, about ¼ of the length of the head. Barbels short, simple. Skin between rows of shields with many rows of small prickle-like plates; last dorsal shield very small, less than ½ the one before it. Shields rather large and smoothish. Anal about half dorsal and entirely below it. Dorsal shield 11 (8 to 11); lateral 32 (22 to 33); ventral 9 (6 to 9); D. 41; A. 22. Cape Cod to Florida, rare northward, extending further southward than other species; our specimen from Charleston. (*brevis*, short; *rostrum*, snout.)

*Acipenser brevirostrum*, Le Sueur, Trans. Amer. Phil. Soc., I, 390, 1818; Günther, Cat., VIII, 841; Jordan & Gilbert, Synopsis, 87, 1883.

*Acipenser obtusirostris*, Lovetzky, Nouv. Mem. Soc. Nat., III, 257 (after Le Sueur).

*Acipenser microrhynchus*, New York; *lesueuri*, New York; *dekayi*, New York; and *rostellum*, probably New York; Duméril, Hist. Poiss., II, 164–173, 1870.

## 65. SCAPHIRHYNCHUS,[*] Heckel.

(Shovelnose Sturgeons.)

*Scaphirhynchus*, Heckel, Ann. Wiener Mus. Naturgesch., i, 1835, 71, (*rafinesquei* = *platorynchus*), (not *Scaphorhynchus*, Maximilian, a genus of birds).
*Scaphyrhynchops*, Gill, Trans. Amer. Phil. Soc., v, 12, 178, 1863, (*platorynchus*).

Snout broad, depressed, subspatulate or shovel-shaped. No spiracles. Caudal peduncle very long, strongly depressed, broader than deep. Rows of bony bucklers confluent below the dorsal fin, forming a complete coat of mail on the tail; tail produced in a filament beyond the caudal fin, this longest in the young. Gill rakers somewhat fan-shaped. Pseudobranchiæ obsolete. Species about 4, one of them inhabiting the fresh waters of the United States, the others in Central Asia (Tartary, etc.). (*σκάφη*, spade; *ῥύγχος*, snout.)

### 150. SCAPHIRHYNCHUS PLATORYNCHUS, (Rafinesque).

(Shovelnose Sturgeon; White Sturgeon.)

Body elongate, tapering into a slender, depressed tail, which extends beyond the caudal fin in the form of a filament; this filament is long and slender in the young, but is usually lost in the adult. Bony shields opisthocentrous (or with the bony spine behind the middle), sharply keeled, the series confluent below the dorsal, obliterating the smaller plates between; 2 occipital plates, with short keels; a spine in front of eye, and one at the posterior edge of the rostral "shovel": snout in the young with a few spines. Barbels nearer mouth than tip of snout. Greatest width of head about ½ its length. None of the fulcra enlarged. Dorsal and anal small; anal a little more than ½ length of dorsal and entirely behind it. Gill rakers small, lamellate, somewhat fan-shaped, ending in 3 or 4 points. Dorsal shields 18 (15 to 20); lateral 46 (41 to 46); ventral 13 (11 to 13). D. 32; A. 20. Head 4 in length. Color pale olive. L. 5 feet. Mississippi Valley and streams of the western and southern States; common. (*πλατύς*, broad; *ῥύγχος*, snout.)

*Acipenser platorynchus*, Rafinesque, Ichth. Oh., 80, 1820, Ohio River.
*Acipenser cataphractus*, Gray, Proc. Zoöl. Soc. London, 1834, 122.
*Scaphirhynchus rafinesquei*, Heckel, Ann. Wiener Mus. Naturgesch., i, 1835, 71.
*Scaphirhynchus cataphractus*, Günther, Cat., viii, 345, 1870.
*Scaphirrhynchops platyrrhynchus*, Jordan & Gilbert, Synopsis, 88, 1883.
*Scaphirhynchus platyrhynchus*, Kirsch & Fordice, Proc. Ac. Nat. Sci. Phila., 1889, 246.

## HOLOSTEI.

(The Bony Ganoids.)

Skeleton bony. Ventral fins abdominal, with the basilar segments rudimentary, as in ordinary fishes. Primary radii of posterior limb generally reduced to one rudiment. Suboperculum and preoperculum present. Branchiostegals present. Coronoid bone and mesocoracoid present. Arterial bulb with several pairs of valves. Optic nerves forming a chiasma. Intestine with a spiral valve. Air bladder cellular, lung-like, connected by a sort of glottis with the œsophagus. Tail heterocercal. Skin covered with scales, which are ganoid or cycloid. As here understood, this group consists of the two orders RHOMBOGANOIDEA and CYCLOGANOIDEA, the CROSSOPTERYGII* being considered as forming a distinct subclass. (GANOIDEI HOLOSTEI, part, Günther, Cat., VIII, 324–325, 328-331.) (ὅλος, complete; ὀστέον, bone; also called HYOGANOIDEA.)

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[*] By the rules of the American Ornithologists' Union, the generic name *Scaphirhynchops* should be preferred. We regard all generic names not spelled alike as distinct.

## Order K. RHOMBOGANOIDEA.

### (THE GAR PIKES.)

Parietals in contact; pterotic, basis cranii, and anterior vertebræ simple; symplectics present. Mandible with coronoid, angular, articular, and dentary bones; third superior pharyngeal small, lying on fourth; upper basihyal wanting; maxillary transversely divided. A cartilaginous mesocoracoid. Vertebræ opisthocœlian, that is, connected by ball-and-socket joints, the concavity in each vertebra being behind. Pectoral fins with mesopterygium and 5 other basal elements. Tail heterocercal. Air bladder lung-like, single, connecting with the dorsal side of the œsophagus. This order consists of a single family, LEPISOSTEIDÆ, (ῥόμβος, rhomb; GANOIDEA; also called GINGLYMODI, γίγγλυμος, hinge; εἶδος, like, in allusion to the hinge joints of the vertebræ.)

## Family XXXII. LEPISOSTEIDÆ.

### (THE GAR PIKES.)

Body elongate, subcylindrical, covered with hard, rhombic ganoid scales or plates, which are imbricated in oblique series running downward and backward. Both jaws more or less elongate, spatulate or beak-like, the upper jaw projecting beyond the lower. Premaxillary forming most of the margin of the upper jaw; the maxillary transversely divided into several pieces. Lower jaw composed of as many pieces as in reptiles; coronoid present. Both jaws with an outer series of small teeth, followed by 1 (or 2) series of large teeth, besides which on the jaws, vomer, and palatines are series of small, close-set, rasp-like teeth. Large teeth of the jaws conical in form, pointed and striate, placed at right angles to the jaw; these large teeth rest, according to Agassiz, in a rather deep furrow, protected on the outside by the raised border of the jaw, and on the inside by a ridge of the same nature; these teeth are pierced in the center by a foramen, which communicates with the maxillary canal, and through which the nerves and blood vessels enter the pulp cavity of the tooth; the forms of the folded layers of dentine within the teeth are peculiar. Pharyngeals with rasp-like teeth. Tongue toothless, short, broad, emarginate, free at tip. External bones of skull very hard and rugose. Eyes small. Nostrils near the end of the upper jaw. An accessory gill on the inner side of the opercle. Pseudobranchiæ present. No spiracles. Gills 4, a slit behind the fourth. Branchiostegals 3. Gill membranes somewhat connected, free from the isthmus. Gill rakers very short. Air bladder cellular, lung-like, somewhat functional. Fins with fulcra; dorsal fin short, rather high, posterior, nearly opposite the anal, which is similar in form; tail heterocercal, in the young produced as a filament beyond the caudal fin; caudal convex; ventrals nearly midway between pectorals and anal; pectorals and ventrals moderate, few-rayed. Stomach not cœcal; pyloric appendages numerous. Spiral valve of intestines rudimentary. Fishes of the fresh waters of North America and China, of sluggish habits, but voracious and destructive to smaller fishes. The flesh is tough and rank, valueless as food. One genus with about 5 species, although more than 40 have been described. These fishes are of much interest to geologists from their relationship to extinct ganoid genera, many of which are usually placed in this family. (LEPIDOSTEIDÆ, Günther, Cat., VIII, 328–331.)

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* *Polypteridæ*; all the species belonging to the Old World.

### 66. LEPISOSTEUS, Lacépède. GAR PIKES.

*Lepisosteus*, LACÉPÈDE, Hist. Nat. Poiss., v, 331, 1803, (*gavialis* = *osseus*).
*Cylindrosteus*, RAFINESQUE, Ich. Ohiensis, 72, 1820, (*platostomus*).
*Atractosteus*, RAFINESQUE, *l. c.*, 72, (*ferox*).
*Sarchirus*, RAFINESQUE, *l. c.*, 86, (*argenteus*).
*Lepidosteus*, AGASSIZ, (corrected spelling).

Upper jaw with an outer series of small, sharp, even teeth, then a series of large teeth, some of the anterior teeth being usually movable; next comes a series of fine teeth, in one row in front, becoming a band behind. In some species, the inner row of these teeth contains larger ones; next the vomerine teeth, also in a long band, and posteriorly a palatine band. These bands on the roof of the mouth are frequently somewhat confluent or irregular. In young specimens some of the palatine teeth are often enlarged, these sometimes forming regular series. Lower jaw with an outer series of small teeth, next a series of large teeth, next again a broad band of fine teeth on each side. Each of the large teeth fitting into a depression in the opposite jaw. Rivers of North America. A single species (*L. sinensis*, Bleeker) found in China. (λεπίς, scale; ὀστέον, bone.)

*a.* Large teeth of upper jaw in a single row on each side.
  LEPISOSTEUS:
    *b.* Beak long and slender; the snout more than twice the length of the rest of the head. OSSEUS, 151.
  CYLINDROSTEUS, (κύλινδρος, cylinder; ὀστέον, bone):
    *bb.* Beak shorter and broader, little longer than rest of head. PLATOSTOMUS, 152.
ATRACTOSTEUS,* (ἀτρακτός, spindle; ὀστέον, bone):
  *aa.* Large teeth in upper jaw in 2 rows on each side; beak short and broad, not longer than rest of head.
    *c.* Scales in lateral line about 60. TRISTŒCHUS, 153.
    *cc.* Scales larger, those in lateral line 52. TROPICUS, 154.

### Subgenus LEPISOSTEUS.

### 151. LEPISOSTEUS OSSEUS, (Linnæus).

(LONG-NOSED GAR; BILLFISH; COMMON GAR PIKE.)

Snout a little more than twice the length of the rest of the head, its length 15 to 20 times its least width. Olivaceous, pale, and somewhat

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*The name *Litholepis*, Rafinesque, applied by him to a gigantic gar, *Litholepis adamantinus*, the "Devil-jack Diamond fish," is based on a drawing by Audubon, not intended by Audubon to represent any possible fish.

silvery below; vertical fins and posterior part of the body with round black spots, which are more distinct in the young; very young with a blackish lateral band. Head 3 in length; depth 12. D. 8; A. 9; V. 6; P. 10. Lat. line about 62. L. about 5 feet. Great Lakes and rivers of the United States from Vermont to the Rio Grande; generally abundant and quite variable, the local variations having given rise to many specific names.* Southern specimens are often more distinctly spotted. A detailed comparison of many specimens, from different parts of the country, will probably show the existence of recognizable subspecies, but this comparison is yet to be made. (*osseus*, bony.)

*Esox osseus*, Linnæus, Syst. Nat., Ed. x, 1758, 313, after Artedi, based on *Acus maxima squamosa viridis*, the Green Gar Fish of Catesby, 1738, pl. 30, Virginia.
*Esox viridis*, Gmelin, Syst. Nat., 1389, 1788, also after Catesby.
*Lepisosteus gavailis*, Lacépède, Hist. Poiss., v, 333, 1803, "lakes and rivers of both Indies."
*Lepisosteus oxyurus*, Rafinesque, Ichth. Oh., 73, 1820, Ohio River.
*Lepisosteus longirostris*, Rafinesque, *l. c.*, 74, 1820, Ohio River.
*Lepisosteus huronensis*, Richardson, Fauna Bor. Amer., iii, 237, 1836; Penetanguishene, Lake Huron; Günther, Cat., viii, 330, 1870.
*Lepidosteus gracilis*, Agassiz, Poissons Fossiles, ii, 2, 1836.
*Lepidosteus osseus* Günther, Cat., viii, 330, 1870.
*Lepisosteus semiradiatus*, Agassiz, *l. c.*, ii, 2, plate 2, 1836.
*Lepidosteus osseus*, Jordan & Gilbert, Synopsis, 91, 1883.
*Sarchirus vittatus*, and *Sarchirus argenteus*, Rafinesque, Ichth. Oh., 86, 1820, (young), Ohio River.
*Lepisosteus bison*, De Kay, New York Fauna: Fishes, 271, 1842, Buffalo, New York.
*Lepisosteus lineatus*, Thompson, Hist. Vermont, 145, 1842, Lake Champlain.
*Macrognathus loricatus*, Gronow, Cat. Fish., 148, 1854, after Linnæus.
*Lepidosteus leptorhynchus*, Girard, Pac. R. R. Expl., 351, 1858, Devil River, Texas.
*Lepidosteus crassus*, Cope, Proc. Ac. Nat. Sci. Phila., 1865, 86, Bombay Hook, Delaware River.
*Lepidosteus otarius*, Cope, *l. c.*, 86, "Platte River near Fort Riley;" but Fort Riley was on the the Kansas River.

### Subgenus CYLINDROSTEUS, Rafinesque.

### 152. LEPISOSTEUS PLATOSTOMUS, Rafinesque.

(Short-nosed Gar.)

Snout usually about ⅓ longer than the rest of the head, sometimes about equal to it, its length 5 to 6 times its least width. Colors of *L. osseus* or rather darker. Head 3½ in length; depth 8. D. 8; A. 8; V. 6. Lat. line about 56. L. 2 to 3 feet. Great Lakes and southern and western rivers, with the preceding, but less abundant northward. Still more variable than the preceding; possibly more than 1 species confounded; not always readily distinguishable from the young of the next. (*πλατύς*, broad; *στόμα*, mouth.)

*Lepisosteus platostomus*, Rafinesque, Ichth. Oh., 72, 1820, Ohio River.
*Lepisosteus albus*, Rafinesque, *l. c.*, 73, Ohio River.
*Lepisosteus platystomus*, Günther, Cat., viii, 329, 1870; Jordan & Gilbert, Synopsis, 91, 1883.

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*M. Auguste Duméril (Hist. Nat. Poiss., Vol. ii, 1870) divides this species, as represented in the Museum at Paris, into 17, which are distinguished by trifling differences in proportions and numbers of scales. His new names are *L. treculi*, Mississippi, 327; *L. milberti*, New York, 328; *L. harlani*, Wabash River, 329; *L. smithi*, upper Mississippi, 330; *L. ayresi*, Wabash River, 331; *L. copei*, northern North America, 332; *L. lesueuri*, Wabash River, 335; *L. elisabeth*, no locality, 336; *L. lamari*, northern North America, 337; *L. clintonii*, no locality, 338; *L. troosti*, United States, 339; *L. piquotianus*, Lake Erie, 340; *L. horatii*, northern North America, 341; *L. thompsoni*, upper Mississippi, 342; *L. louisianensis*, New Orleans, 344.

*Lepidosteus grayi*, AGASSIZ, Poissons Fossiles, II, 2, 1836, Louisiana.
*Lepisosteus platyrhincus*, DE KAY, N. Y. Fauna: Fishes, 273, 1842, Florida.
*Lepidosteus latirostris*, GIRARD, Pac. R. R. Expl., 352, 1858, Rio Pecos, Texas.
*Lepidosteus oculatus*, WINCHELL, Proc. Ac. Nat. Sci. Phila., 1864, 183, Huron River, Mich.
*Cylindrosteus productus*, COPE, Proc. Ac. Nat. Sci. Phila., 1865, 86, San Antonio, Texas.
*Cylindrosteus agassizii*, DUMÉRIL, Hist. Nat. Poiss., II, 351, 1870, St. Louis.
*Cylindrosteus zadocki*, DUMÉRIL, *l. c.*, 353, upper Mississippi.
*Cylindrosteus rafinesquei*, DUMÉRIL, *l. c.*, 354, United States.
*Cylindrosteus castelnaui*, DUMÉRIL, *l. c.*, 355, Lake Lafayette, Florida.
*Cylindrosteus bartoni*, DUMÉRIL, *l. c.*, 356, New Orleans.

### Subgenus ATRACTOSTEUS, Rafinesque.

### 153. LEPISOSTEUS TRISTŒCHUS, (Bloch & Schneider).

(ALLIGATOR GAR; GREAT GAR; MANJUARI.)

Snout usually not quite so long as the rest of the head, its least width contained 3½ times in its length. Head 3½ in length. D. 8; A. 8; V. 6. Lat. line 60. Scales in an oblique series from the ventrals to middle of back 18 to 20. Color greenish, paler below, the adult usually not spotted. L. 8 to 10 feet. Rivers of the southern States, Cuba, and northern Mexico, north to St. Louis and Cincinnati. A huge, muscular, voracious fish, useless as food, remarkable for its armature of enameled scales. (*τρεῖς*, three; *στοῖχος*, row.)

*Esox tristœchus*, BLOCH & SCHNEIDER, Syst. Ichth., 395, 1801, Cuba, after Manjuari of Para.
*Lepisosteus spatula*, LACÉPÈDE, Hist. Poiss., V, 333, 1803, no locality.
*Lepisosteus (Atractosteus) ferox*, RAFINESQUE, Ichth. Oh., 73, 1820, Ohio River.
*Lepidosteus manjuari*, POEY, Memorias, I, 273, 1860, Cuba.
*Lepidosteus (Atractosteus) berlandieri*, GIRARD, Pac. R. R. Expl., 353, 1858, Tamaulipas.
*Lepidosteus viridis*, GÜNTHER, Cat., VIII, 329, 1870, not *Esox viridis*, GMELIN, which is *L. osseus.*
*Litholepis tristœchus*, JORDAN & GILBERT; Synopsis, 92, 1883.
*Atractosteus lucius*, DUMÉRIL, *l. c.*, 364, 1870, Tampico, Mexico.

### 154. LEPISOSTEUS TROPICUS, (Gill).

Head 4 in extreme length; depth 8½; scales 8–52 to 54–12. Otherwise as in *L. tristœchus*, from which it may not be distinguishable. (Gill.) Streams of the Pacific Coast of Central America. (*tropicus*, tropical.)

*Atractosteus tropicus*, GILL, Proc. Ac. Nat. Sci. Phila., 1863, 172, streams near Panama.
*Atractosteus tropicus*, DUMÉRIL, *l. c.*, 367, 1870.

## Order L. CYCLOGANOIDEA.

### (THE BOWFINS.)

Parietals in contact. Pterotic, basis cranii, and anterior vertebræ simple. Mandible with opercular and coronoid. Maxillary not transversely segmented, bordering the mouth. Third superior pharyngeal lying on enlarged fourth. Upper basihyal wanting. Vertebræ amphicœlian, the anterior not modified. Pectoral fins with mesopterygium and 8 other elements. Air bladder cellular and lung-like. This order includes only the family AMIIDÆ. (*κύκλος*, circle; *Ganoidea;* also called HALECOMORPHI, *halecomorphus*, formed like a shad; *halec*, in allusion to the resemblance between this group of GANOIDS and the ISOSPONDYLI. It is probable that the ancestors of the ISOSPONDYLI are to be found among forms allied to the existing HALECOMORPHI.)

## Family XXXIII. AMIIDÆ.

### (THE BOWFINS.)

Body oblong, compressed behind, terete anteriorly. Head subconical, anteriorly bluntish, slightly depressed, its superficial bones corrugated and very hard, scarcely covered by skin. Snout short, rounded; lateral margins of upper jaw formed by the maxillaries, which are divided by a longitudinal suture. Jaws nearly even in front; cleft of the mouth nearly horizontal, extending beyond the small eye; lower jaw broad, U-shaped, the rami well separated; between them a broad bony plate, with radiating striæ, its posterior edge free; jaws each with an outer series of conical teeth, behind which in the lower is a band of rasp-like teeth; bands of small teeth on the vomer and pterygoids; palatines with a series of larger, pointed teeth; premaxillaries not protractile; tongue thick, scarcely free at tip. Nostrils well separated, the anterior with a short barbel; suborbital very narrow; a bony plate covering the cheek, similar to the plates on the top of the head; operculum with a broad dermal border. Branchiostegals 10 to 12. No pseudobranchiæ nor opercular gill; no spiracle; gills 4, a slit behind the fourth; gill membranes not connected, free from the isthmus. Two peculiar, long, lanceolate, obliquely striate appendages on each side of the isthmus, projecting backward and covered by the branchiostegal rays, the anterior wholly adnate to the isthmus, the posterior free behind.* Isthmus scaleless. Gill rakers stoutish, very short. Scales of moderate size, rather firm, cycloid, with a membranous border. Lateral line present. Dorsal fin long and low, nearly uniform; the posterior rays not much higher than the others; its insertion in front of the middle line of the body, opposite the end of the pectoral. Tail somewhat heterocercal (more so in the young), convex behind. No fulcra. Anal fin short and low. Pectoral and ventral fins short and rounded, the ventrals nearer anal than pectorals. Vertebræ amphicœlian or double concave, as usual among fishes, none of them specially modified. Abdominal and caudal parts of the vertebral column subequal. Air bladder cellular, bifid in front, lung-like, connected by a glottis with the pharynx, and capable of assisting in respiration. Stomach with a blind sac; no pyloric cœca. No closed oviduct. Intestine with a rudimentary spiral valve. Fresh waters of the United States. A single species known among living fishes. Several fossil genera are usually referred to this family. (AMIIDÆ, Günther, Cat., VIII, 324–325.)

### 67. AMIA, Linnæus.

### (BOWFINS.)

*Amia*,† LINNÆUS, Syst. Nat., Ed. XII, 1766, 500; (*calva*), not of Gronow, 1763, which is a non binomial name for *Apogon*.

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* See Wilder "On the Serrated Appendages of the Throat of Amia," Proc. Amer. Assoc. Adv Sci., 1876, 259, for a discussion of these curious organs.

†If the nonbinomial generic names of Gronow are to be recognized, the name *Amia* must be transferred to *Apogon* and the present genus must be called *Amiatus*. The date of Gronow's work lies between that of the tenth edition (1758), of Linnæus, Systema Naturæ, and that of the twelfth (1766). The character of Gronow's work is essentially pre-Linnæan, and it contains no reference to the Linnæan system. It seems to us that the genera of nonbinomial writers should not be given precedence over those of the binomial system.

*Amiatus*, RAFINESQUE, Analyse de la Nature, 88, 1815, (*calva*); substitute for *Amia*, regarded as too short for symmetry.

Characters of the genus included above. (*ἀμία*, ancient name of some fish, probably the bonito, *Sarda sarda.*)

### 155. AMIA CALVA, Linnæus.

(MUDFISH; DOGFISH; BOWFIN; GRINDLE; "JOHN A. GRINDLE;" LAWYER; POISSON DE MARAIS.)

Dark olive or blackish above, paler below; sides with traces of dark reticulate markings; lower jaw and gular plate often with round blackish spots; fins mostly dark, somewhat mottled. Male with a round black spot at base of caudal above, this surrounded by an orange or yellowish shade; in the female this ocellus is wanting. Lateral line nearly median, directed slightly upward at each end. D. 48 (42 to 53); A. 10 to 12; V. 7. Lat. line, 67 (65 to 70). Head 3⅗ in length; depth 4 to 4½. Male about 18 inches in length; female 24 or more. Great Lakes and sluggish waters from Minnesota to Virginia, Florida, and Texas; abundant. A voracious and gamy fish of remarkable tenacity of life. The flesh is peculiarly soft and pasty and is of no value for food.

*Amia calva*, LINNÆUS, Syst. Nat., Ed. XII, 1766, 500, Charleston, S. C.; GÜNTHER, Cat., VIII, 325, 1870.

*Amia ocellicauda*, RICHARDSON, Fauna Bor. Amer., III, 236, 1836, ♂, Lake Huron.

*Amia occidentalis*, DE KAY, New York Fauna: Fishes, 269, 1842, ♀, St. Marys River, Mich.

*Amia marmorata*, CUVIER & VALENCIENNES, XIX, 412, 1846, New Orleans.

*Amia ornata*, LE SUEUR, in Cuvier & Valenciennes, *l. c.*, 420, Chibault, on Mississippi River.

*Amia viridis*, LE SUEUR, *l. c.*, 421, New Orleans.

*Amia canina*, CUVIER & VALENCIENNES, *l. c.*, 424, Lake Erie, after Kirtland.

*Amia lentiginosa*, CUVIER & VALENCIENNES, *l. c.*, 426, after Bonnaterre, no locality.

*Amia subcærulea*, CUVIER & VALENCIENNES, *l. c.*, 427, New Orleans.

*Amia cinerea*, CUVIER & VALENCIENNES, *l. c.*, 430, Charleston, South Carolina.

*Amia reticulata*, LE SUEUR, *l. c.*, 431, Wabash River.

*Amia thompsoni*, DUMÉRIL, Hist. Nat. Poiss., II, 419, 1870, Lake Champlain.

*Amia piquotii*, DUMÉRIL, *l. c.*, 423, 1870, Upper Mississippi.

## Series TELEOSTEI.

## (THE BONY FISHES.)

This group is sufficiently characterized in the analysis on page 97. The name (*τέλειος*, perfect; *ὀστέον*, bone) is not entirely distinctive, inasmuch as the skeleton is well ossified in certain Ganoids. In general, however, the group is well characterized by the absence of the anatomical features ascribed to the Ganoids.

We begin the series with those Teleosts in which the air bladder connects throughout life with the alimentary canal as distinguished from those in which this connection is a feature of immaturity. Slight as this character is, it has value as an indication of relationship. Among these forms in which the air duct is retained there are 2 well-marked series, probably distinct in origin, the one characterized by a singular modification of the anterior vertebræ, the other without this character. The first of the groups (OSTARIOPHYSI) includes the great majority of living fresh-water fishes. From the other group the specialized spiny-rayed fishes and most marine fishes seem to be descended.

## OSTARIOPHYSI.

This group, which includes the great majority of the living fresh-water fishes of the world, is characterized chiefly by the modification of the anterior vertebræ. These are coössified and have some of their lateral and superior elements detached and modified to form a chain of small bones, the Weberian ossicles, which connect the air bladder with the ear. The three orders, NEMATOGNATHI, PLECTOSPONDYLI, and SCYPHOPHORI (*Mormyridæ*), which compose this group, are doubtless derived from a common stock. (*ὀστάριον*, a little bone; *φῦσος*, bladder.)

## Order M. NEMATOGNATHI.

### (THE CATFISHES.)

Parietals and supraoccipital confluent. Four anterior vertebræ coössified, and with ossicula auditus or weberian apparatus. No mesopterygium. Basis cranii and pterotic bone simple; no coronoid bone. Third superior pharyngeal bone wanting, or small and resting on the fourth; second directed backwards. One or 2 pairs of basal branchihyals; 2 pairs of branchihyals. Suboperculum wanting, or modified into the uppermost branchiostegal. Mesocoracoid present. Premaxillary forming border of mouth above, except in one family, DIPLOMYSTIDÆ, in which the maxillaries also bear teeth. Interclavicles present. No scales. Skin naked or with bony plates.

"This division is the nearest ally to the sturgeons (CHONDROSTEI) among Physostomous fishes, and I imagine that future discoveries will prove that it has been derived from that division by descent. In the same way the Isospondylous fishes are nearest the HALECOMORPHI, and have probably descended from some Crossopterygian, near the HAPLISTIA, through that order. The affinity of the catfishes to the sturgeons is seen in the absence of symplectic, the rudimental maxillary bone, and, as observed by Parker, in the interclavicles. There is a superficial resemblance in the dermal bones."—(Cope, *l. c.*, 454.)

This group comprises the SILURIDÆ[*] and their relatives, now divided into several families by Prof. Gill. (SILURIDÆ, Günther, Cat., v, 1–277.) (*νῆμα*, thread; *γνάϑος*, jaw; from the maxillary barbels, which are always present.)

### ANALYSIS OF FAMILIES OF NEMATOGNATHI.

*a.* Air bladder well developed, usually simple or with transverse constrictions, lying free in the abdominal cavity. Mouth terminal; teeth villiform, conical, incisor or molar like; intestines short; arranged in longitudinal folds; body naked, or with one series of lateral plates; diaphragm membranous; tip of scapular process reaching basioccipital. Dorsal fin short, confined to the abdominal part of the vertebral column; opercle well developed and movable; adipose fin normally present; gill openings generally wide; caudal vertebræ not compressed, the neural spines simple, spine-like. Maxillary rudimentary, forming the base of a long barbel, the premaxillaries alone forming the margin of the upper jaw. SILURIDÆ, XXXIV.

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[*] In the arrangement of the tropical genera of NEMATOGNATHI, we have followed closely the "Revision of the South American NEMATOGNATHI," by Eigenmann & Eigenmann, 1890.

*aa.* Air bladder rudimentary, one division on either side of the coalesced vertebræ and entirely surrounded by a bony capsule; this capsule formed by the skull and by the lateral processes of the anterior vertebræ; diaphragm wholly osseóus, formed by the expansions of the clavicle and scapular process. Scapula and its process firmly joined to the skull. Gill membranes joined to the isthmus; skin covered with bony plates.

*b.* Caudal vertebræ compressed, the neural and hæmal spines expanded, forming a continuous ridge above and below; skin with several series of plates; mouth inferior, the lower lip reverted; teeth turned abruptly back above and usually expanded; a single series of teeth erect and in function, the premaxillaries and dentaries box-shaped, filled with numerous relay teeth; intestinal canal coiled; cavity of air bladder communicating with the exterior at a notch in the posterior margin of the temporal plate at beginning of lateral line. LORICARIIDÆ, XXXV.

## Family XXXIV. SILURIDÆ.

### (THE CATFISHES.)

Body more or less elongate, naked or covered with bony plates. No true scales. Anterior part of head with 2 or more barbels, the base of the longest pair formed by the small or rudimentary maxillary. Margin of upper jaw formed by premaxillaries only. Suboperculum absent; operculum present. Dorsal fin usually present, short, above or in front of the ventrals. An adipose fin usually present. Anterior rays of dorsal and pectorals usually spinous. Air bladder usually present, large, and connected with the organ of hearing by means of the auditory ossicles. Lower pharyngeals separate.

After the removal of numerous aberrant forms as distinct families, the family of SILURIDÆ contains more than 100 genera and upward of 900 species. Most of the SILURIDÆ are fresh-water fishes, inhabiting the rivers of warm regions, particularly South America and Africa; comparatively few of them are marine, and these few are mostly tropical. They are especially characteristic of the Amazon region in South America. (SILURIDÆ, part, Günther, Cat., v, 30–65; 69–220.)

*a.* Gill membranes free or forming a free fold across the isthmus, rarely joined to the isthmus; anal fin shorter than caudal portion of vertebral column.

TACHYSURINÆ:

*b.* Nostrils close together, neither with a barbel, the posterior with a valve; teeth on the palate; caudal forked. (Species chiefly marine.)

*c.* Lower jaw with 2 barbels; maxillary barbel band-like; pectoral spine with a band-like filament. FELICHTHYS, 68.

*cc.* Lower jaw with 4 barbels; palatine teeth fixed; both jaws with teeth.

*d.* Gill rakers few, 5 to 25; eyes above level of mouth. GALEICHTHYS, etc., (genera 69 to 74).

*dd.* Gill rakers very many—40 or more, long and slender; eyes scarcely above level of mouth. CATHOROPS, 75.

*bb.* Nostrils remote from each other. (Fresh-water species.)

ICTALURINÆ:

*e.* Posterior nostril with a barbel; barbels 8; no teeth on vomer or palate.

*f.* Adipose fin with its posterior margin free.

*g.* Premaxillary band of teeth truncate behind; not produced backward at the outer angles.

*h.* Eyes normal.

*i.* Supraoccipital bone continued backward from the nape, its notched tip receiving the bone at base of dorsal spine, so that a continuous bony bridge is formed under the skin from snout to base of dorsal; caudal fin forked. ICTALURUS, 76.

*ii.* Supraoccipital not reaching interspinal bones, the bony bridge more or less incomplete. AMEIURUS, 77.

*gg.* Premaxillary band of teeth with a lateral backward extension on each side; lower jaw projecting; dorsal spine weak. LEPTOPS, 78.

*ff.* Adipose fin keel-like, adnate to the back.

*j.* Band of teeth in upper jaw with a backward extension at its outer posterior angle, as in *Leptops*. NOTURUS, 79.

*jj.* Band of teeth in upper jaw without backward extension, as in *Ameiurus*. SCHILBEODES, 80.

PIMELODINÆ:

*ee.* Posterior nostril without barbel; barbels 6; adipose fin well developed; teeth in villiform bands.

*k.* Teeth on vomer none, or in small patches.

*l.* Head covered with soft skin above, not granulated. Snout broad, scarcely produced; barbels terete or slighlty flattened, not margined; head longer than broad.

*m.* Occipital process, if present, not reaching the dorsal plate; dorsal spine pungent. RHAMDIA, 81.

*mm.* Occipital process narrow, reaching the dorsal plate; fontanelle reaching base of occipital process, a bridge across it above posterior margin of eye; humeral process spine-like. PIMELODELLA, 82.

*ll.* Head granulated above, naked or partially naked; occipital process usually reaching dorsal plate; fontanelle not continued behind eyes; adipose fin longer than high; humeral process broad; not spine-like. PIMELODUS, 83.

## 68. FELICHTHYS, Swainson.

### (GAFF-TOPSAIL CATFISHES.)

*Breviceps*, SWAINSON, Nat. Hist. Fishes, 1, 328, 1838, (*bagre*), name preoccupied.
*Felichthys*, SWAINSON, *l. c.*, II, 305, 1839, substitute for *Breviceps*, (*bagre*).
*Ailurichthys*, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 26, (*marinus*).
*Ælurichthys*, GILL, corrected spelling.
*Mystus*, GRONOW, Cat. Fishes, Ed. Gray, 165, 1854, (*carolinensis*), name preoccupied.
*Pimelodus*, BLEEKER, Silures de Suriname, 65, 1864, (*bagre*), not of Lacépède, as restricted by Gill.

Body rather elongate, little compressed. Head depressed, broad above. Mouth large, the upper jaw the longer. Teeth all villiform; those on the vomer and palatines forming a more or less perfectly crescent-shaped band. Barbels 4; maxillary barbels band-like, very long; chin with 2 short barbels. Nostrils close together, the posterior with a valve; nuchal region with a granulated, bony buckler. Fontanelle large, well forward. Dorsal fin short, in front of the ventrals, with 1 sharp spine and 7 rays. Pectorals with a similar spine; pectoral spines, and sometimes dorsal spine also, ending in a long, striated, band-like filament. Adipose fin moderate, free behind. Caudal fin widely forked; anal moderate, emarginate; ventral rays 6. Gill membranes somewhat connected. Tropical waters of America, the species all marine. (*felis*, cat; ἰχθύς, fish.)

*a.* Dorsal spine not produced in a long filament; occipital process large, shaped like a clover leaflet; gill rakers 5 + 14; base of ventrals about equidistant from snout and caudal. PANAMENSIS, 156.

*aa.* Dorsal spine produced in a long filament; occipital process normal; gill rakers not more than 9.

*b.* Distance from dorsal fin to tip of snout 3⅓ to 4 in length; base of anal more than ⅕ length.

*c.* Anterior lobe of anal with minute dots, its highest ray less than ½ its base; vomerine and palatine patches of teeth separate; anal rays 32 to 35. BAGRE, 157.

*cc.* Anterior lobe of anal with a large dark blotch, its highest ray more than ½ its base; vomerine and palatine patches of teeth joined; anal rays 28 to 30. PINNIMACULATUS, 158.

*ccc.* Head broader; occipital process narrower than in *F. pinnimaculatus;* body and fins uniformly colored; no black blotch on ventrals or anal. EYDOUXII, 159.

*bb.* Distance of dorsal from tip of snout about 3 in length; highest anal ray about equal to base of anal, which is about ⅙ the length; anal rays 20 to 26.

*d.* Anal rays about 26; occipital buckler large, triangular, its width at base 1⅙ in its length. FILAMENTOSUS, 160.

*dd.* Anal rays 22 to 24; occipital buckler small, oblong, nearly as wide behind as before; top of head smoother than in most other species; pectoral spine shorter than head, a little longer than dorsal spine. MARINUS, 161.

*ddd.* Anal rays 19 to 21; pectoral spine as long as head, much longer than dorsal spine; palatine teeth in a narrow band. BAHIENSIS, 162.

### 156. FELICHTHYS PANAMENSIS, (Gill).

Body robust; dorsal spines not produced; maxillary barbels reaching base of ventrals; caudal deeply forked. Steel blue, with bright reflections; fins dotted. Head 4; depth 5. D. I, 7; A. 29. Mazatlan to Panama; common. (*panamensis*, from Panama.)

*Ailurichthys panamensis*, GILL, Proc. Ac. Nat. Sci. Phila., 1863, 172, Panama.
*Ailurichthys nuchalis*, GÜNTHER, Cat., v, 179, 1864, Panama.
*Ailurichthys panamensis*, EIGENMANN & EIGENMANN, S. A. Nematognathi, 31, 1890.

### 157. FELICHTHYS BAGRE, (Linnæus).

Body rather elongate; maxillary barbels reaching beyond front of anal; gill rakers very slender, 2 + 6; dorsal filament reaching caudal. Dark purplish, fins dotted. Head 4¾; depth 5¼. D. I, 7; A. 32 to 35. Coast of Brazil, accredited to the West Indies, but rare north of Surinam. (*bagre*, Portuguese name of some catfish.)

*Silurus bagre*, LINNÆUS, Syst. Nat., Ed. XII, 505, 1766, South America, after Gronow.
*Ailurichthys bagre*, EIGENMANN, S. A. Nematognathi, 33, 1890.
*Galeichthys gronovii*, CUVIER & VALENCIENNES, XV, 40, 1840, Guiana, Maracaibo, Naua, Bahia, Cayenne.
*Ailurichthys gronovii*, GÜNTHER, Cat., v, 178, 1864.
*Bagrus macronemus*, RANZANI, Nov. Com. Ac. Sci. Bonon. 1842, v, 334, pl. 28, Brazil.
*Mystus carolinensis*, GRONOW, Cat. Fishes, Ed. Gray, 156, 1854, Rivers of South America.

### 158. FELICHTHYS PINNIMACULATUS, (Steindachner).

Rather elongate; maxillary barbels reaching middle of anal; dorsal spine 1⅓ in head, its filament reaching to caudal. Metallic blue; anal with a large black blotch in front; lower caudal lobe pale. Head 4⅗; depth 4⅗. D. I, 7; A. 28 to 30. Mazatlan to Panama; common on sandy shores. (*pinna*, fin; *maculatus*, spotted.)

*Ailurichthys pinnimaculatus*, STEINDACHNER, Ichth. Beitr., IV, 15, 1875, Panama, Altata, Costa Rica; EIGENMANN, *l. c.*, 35, 1890.

### 159. FELICHTHYS EYDOUXII, (Cuvier & Valenciennes).

Head broader than in *F. pinnimaculatus.* Dorsal shield as long as broad, the lateral edges rounded; its surface granulated and grooved; occipital process narrower than in *F. pinnimaculatus.* Teeth on palate forming a transverse band, subinterrupted in the middle. Maxillary barbel reaching middle of pectoral spine. Dorsal spine grooved, granulated on anterior edge; pectoral filament reaching end of anal. Body and fins uniformly colored, no black blotch on ventrals or anal. Head 4¾. D. I, 7; A. 30. Guayaquil. (Sauvage.) (Named for M. Eydoux, its discoverer.)

*Galeichthys eydouxii*, CUVIER & VALENCIENNES, XV, 43, 1840, Guayaquil.
*Ailurichthys eydouxii*, SAUVAGE, in Jordan, Proc. U. S. Nat. Mus., 1884, 40; description of original type.

### 160. FELICHTHYS FILAMENTOSUS, Swainson.

Very close to *F. marinus*, which it represents southward. Shields on top of head rougher than in *F. marinus*, the granulations extending on each side of fontanelle to before it; granulated area before occipital process broader than long, its width more than ½ head; occipital process triangular, emarginate behind, its width at base 1⅙ in its length; basal bone of dorsal spine short but broad. Dorsal spine a little shorter than head, a little longer than pectoral spine; its filament reaching to or beyond adipose fin; pectoral filament to front of anal; maxillary barbels to end of pectoral spine. A. 26. Sandy coast of tropical America, on the Atlantic side; here described from specimens from Lake Nicaragua. (*filamentosus*, bearing filaments.)

*Felichthys filamentosus*, SWAINSON, Nat. Hist. Anim., II, 305, 1839, after Bloch, pl. 365.
*Ailurichthys filamentosus*, JORDAN, Proc. U. S. Nat. Mus., 1888, 411.
*Galeichthys blochii*, CUVIER & VALENCIENNES, XV, 44, 1840, Bahia.

### 161. FELICHTHYS MARINUS, (Mitchill).

(SEA CATFISH; GAFF TOPSAIL.)

Head rather short and broad, rounded anteriorly. Occipital buckler small, oblong, not much broader before than behind; band of palatine teeth nearly continuous, extremely variable. Maxillary barbels extending about to the end of the pectoral spine; pectoral spine longer than the dorsal spine, ⅔ the length of the head, its filament reaching the vent; dorsal filament reaching adipose fin; upper lobe of caudal much the longer; anal fin falcate. Dusky bluish, silvery below. Head 4¼. D. I, 7; A. 23. P. I, 12; B. 6. Vert. 20 + 30. Cape Cod to Texas; common southward; not valued as food.

*Silurus marinus*, MITCHILL, Trans. Lit. and Phil. Soc. N. Y., I, 1815, 433, New York.
*Ailurichthys marinus*, GÜNTHER, Cat., V, 178, 1864.
*Ailurichthys marinus*, JORDAN & GILBERT, Synopsis, 111, 1883.
*Ailurichthys marinus*, EIGENMANN, *l. c.*, 36.

### 162. FELICHTHYS BAHIENSIS, (Castelnau).

Very close to *F. marinus* and perhaps not distinct, the pectoral spine longer, as long as head, the maxillary barbels extending about to root of ventral; palatine teeth in a very narrow band. A. 19 to 21. (Günther.)

Mexico to Bahia, a doubtful species, placed by Eigenmann with *F. filamentosus*, as synonym of *F. marinus*.

*Galeichthys bahiensis*, CASTLENAU, Anim. Amer. Sud., 37, 1855, Bahia.
*Ailurichthys longispinis*, GÜNTHER, Cat., v, 178, 1864, Mexico; South America.

## 69 to 74. GALEICHTHYS, Cuvier & Valenciennes

### (SEA CATFISH.)

*Tachysurus*, LACÉPÈDE, Hist. Nat. Poiss., v, 151, 1803, (*chinensis*).
*Galeichthys*, CUVIER & VALENCIENNES, XV, 28, 1840, (*feliceps*, etc.)
*Arius*, CUVIER & VALENCIENNES, *l. c.*, 52, (*grandicassis*, *arius*, etc.) (Restricted to *arius* by Bleeker in 1858)=*Tachysurus*.
*Ariodes*, MÜLLER & TROSCHEL, Horæ Ichthyol., III, 9, 1849, (*arenarius*, etc.) (=*Tachysurus*.)
*Hexanematichthys*, BLEEKER, Ichthyol. Archip. Indici Siluri, 61, 1858, (*sondaicus*).
*Cephalocassis*, BLEEKER, *l. c.*, 62, (*melanochir*). (=*Hexanematichthys*.)
*Netuma*, BLEEKER, *l. c.*, 62, (*nasuta*).
*Guiritinga*, BLEEKER, *l. c.*, 62, (*commersoni*). (=*Netuma*.).
*Sciadeichthys*, BLEEKER, *l. c.*, 62, (*emphysetus*).
*Selenaspis*, BLEEKER, *l. c.*, 62, (*herzbergii*).
*Hemiarius*, BLEEKER, Nederl. Tijdskr. Dierk., I, 1862, 90, (*stormi*). (=*Hexanematichthys*.)
*Pseudarius*, BLEEKER, *l. c.*, 91, (*arius*; *grandicassis* being regarded as type of *Arius*). (=*Tachysurus*.)
*Leptarius*, GILL, Proc. Ac. Nat. Sci. Phila., 1863, 170, (*dowi*). (=*Selenaspis*.)
*Ariopsis*, GILL, *l. c.*, (*milberti*=*felis*). (=*Hexanematichthys*.)
*Notarius*, GILL, *l. c.*, (*grandicassis*). (=*Netuma*.)

Body more or less elongate, subterete. Head armed with a bony shield above, behind which projects an occipital shield; another smaller shield at the base of the dorsal spine; these shields usually distinct but sometimes covered by the skin as in *Felichthys*. Skull with a fontanelle. Mouth not large, the upper jaw the longer. Teeth villiform or granular, in a band in each jaw; teeth in 1 or 2 patches each on the vomer and palatines, all of them sometimes confluent into one band; the palatine teeth never movable. Barbels 6 (the nostrils without barbel), close together, the posterior with a valve; maxillary barbels usually short and terete or somewhat compressed. Eyes with a more or less free orbital margin, the upper edge sometimes adnate. Dorsal fin short, in front of the ventrals, with a pungent spine and about 7 rays; adipose fin well developed, posteriorly free; caudal fin deeply forked; anal fin short; pectorals each with a spine; ventral rays 6. Skin smooth, naked, except on the occipital and nuchal regions, where it is usually confluent with the surface of the bony bucklers. Marine catfishes. Species very numerous on sandy shores in the tropical seas, never about coral reefs. This group has been treated as one genus by Günther, Eigenmann, and Jordan & Gilbert. It seems to us more natural to separate the American species into several genera, which is done in the descriptive text below, too late for insertion in the key. (*ταχύς*, swift; *οὐρά*, tail.)

GALEICHTHYS,* (γαλῆ, weasel; ἰχθύς, fish): (genus 69.)

*a.* Head and occiput entirely covered by flesh and skin; occipital process sparingly granulated.

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*This analysis of species is condensed from that given by Eigenmann, S. A. Nematognathi, 43, and from that given by Jordan & Gilbert, Bull. U. S. Fish Com., 1882, 37. We omit from this analysis all those species which have not as yet been found north of Guiana. The subgeneric groups are recognized below as genera.

*b.* Anal fin twice as long as high, with 22 rays; fontanelle with an indistinct groove; occipital process twice as long as broad; sides freckled. LENTIGINOSUS, 163.

*bb.* Anal fin higher than long, with about 15 rays; fontanelle continued as a deep groove to base of occipital process, which is 3 times as long as broad; sides with a broad pale band. PERUVIANUS, 164.

*aa.* Occipital process and bones of head exposed or covered with very thin skin; bones on top of head and occipital process granular.

*c.* Palatine patches of teeth with a backward projecting angle on the inner margin (this often obsolete in the young in *Selenaspis*); vomerine bands contiguous or confluent. General color brown, with bronze reflections.

*d.* Dorsal plate saddle-shaped, enlarged; its length on the median line more than ⅒ that of head; teeth on the palate villiform or bluntly conical; vomerine bands of teeth united.

SCIADEICHTHYS, (*Sciades*, a related genus, from σκιά, shade; ἰχθύς, fish): (genus 70.)

*e.* Posterior nasal openings not connected by a membrane. Species 165–172.

*f.* Dorsal plate longer than broad, pointed in front, entering the short, emarginate occipital process; fontanelle large, ending acutely at a point nearer base of dorsal than tip of snout; eye moderate, 5½ or less in interorbital space; maxillary barbels not reaching beyond base of pectorals; no pterygoid teeth; head 3¼ in length. TROSCHELI, 165.

SELENASPIS, (σελήνη, the moon; ἀσπίς, shield:) (genus 71.) Species 173 to 176.

*ee.* Posterior nasal openings connected by membrane (young with the dorsal plate reduced and no backward prolongation to palatine patch of teeth). Dorsal shield much broader than long, its anterior margin truncate.

*g.* Occipital process very short, truncate behind, ½ wider at base than at tip, its length less than ½ its greatest width; gill rakers 7 + 15; fontanelle short, ending obtusely at a point much nearer tip of snout than front of dorsal; head 3¼ in length. DOWI, 174.

*dd.* Dorsal plate crescent-shaped, not enlarged, its length on the median line much less than ⅒ head.

NETUMA, (*Netuma keleti*, a name used at Pondicherry for *Netuma netuma*): (genus 72.) Species 177 to 185.

*h.* Occipital process widest at its base.

*i.* Fontanelle obtuse, not produced backward as a groove; interorbital region granular; barbels short; caudal not ⅔ head; posterior nostrils not connected by membrane; head very large, 3⅓ in length. KESSLERI, 180.

*ii.* Fontanelle continued backward as a groove (in one species nearly obsolete), and the top of head not granular.

*j.* Interorbital region and shields of head finely granular; no axillary pore; maxillary barbels long, reaching middle of pectorals; caudal more than ⅔ head, which is 4 in length. INSCULPTUS, 181.

*jj.* Interorbital region flat and smooth or with smooth ridges, a triangular smooth area extending backward from it.

*k.* Vomerine patches of teeth united, except in young.

*l.* Groove of fontanelle almost obsolete, not reaching occipital process, which is about as broad at base as long, with concave margins; caudal a little shorter than head, which is 3⅕ in length; shields of head coarsely granular. PLANICEPS, 182.

*ll.* Groove of fontanelle well defined, reaching occipital process, which is longer than broad at base and with straight edges; barbels short, compressed at base; head long 3⅜ in length, its shields finely granular; paired fins often black at base. PLATYPOGON, 183.

*kk.* Vomerine patches of teeth separate on the median line.

*m.* Spines long, scarcely shorter than head ; caudal nearly as long as head ; head small, 4 in length ; mouth small, its breadth not ½ head. OSCULUS, 184.

*mm.* Spines short, not ⅔ head ; head large, about 3⅔ in length; teeth on palate in 4 patches, bluntly conical; occipital process scarcely as long as broad; caudal shortish; mouth large, its breadth at least ½ length of head. ELATTURUS, 185.

*cc.* Palatine patches of teeth without a backward projecting angle on the inner margin; dorsal shield small, crescent-shaped ; general color brown with blue reflections.

HEXANEMATICHTHYS, (ἕξ, six ; νῆμα, thread ; ἰχθύς, fish): (genus 73.) Species 186 to 196.

*n.* Teeth on palate villiform.

*o.* Teeth on palate mostly in 4 patches.

*p.* Granulations of head not extending forward to between eyes.

*q.* Fontanelle continued backward as a narrow groove.

*r.* Occipital process long, about ⅓ head, its tip convex ; inner edge of ventrals pale ; head 3¾ in length. FELIS, 186.

*rr.* Occipital process moderate, not ⅓ head ; inner edge of ventrals black ; head longer.

*s.* Head flat, depressed in front ; occipital keel bluntish ; granulations of head coarse and conspicuous ; fontanelle reaching base of occipital process. SEEMANI, 187.

*ss.* Head scarcely depressed ; occipital keel sharper than in any other species ; shields of head smoother than in *H. seemani;* patches of palatine teeth much smaller, fontanelle narrow, not quite reaching occipital keel. JORDANI, 188.

*qq.* Fontanelle not continued backward as a groove into the granulated region of the head.

*t.* Palatine patches of teeth small, scarcely larger than vomerine patches, which are widely separated ; occipital process keeled, truncate at tip ; barbels rather long ; vertical fins dark ; inside of ventrals dusky. CÆRULESCENS, 189.

*tt.* Palatine patches much larger than vomerine.

*u.* Fontanelle almost obsolete, ending between eyes, not prolonged backward as a groove ; body slender, caudal about as long as head ; paired fins pale. GUATEMALENSIS, 190.

*uu.* Fontanelle ending midway between tip of snout and middle of dorsal plate ; head broader than in preceding. ASSIMILIS, 191.

*pp.* Granulations of head continued forward to between the eyes ; fontanelle continued as a groove to base of occipital process ; interorbital area with 4 granular ridges.

*v.* Head moderate, 4½ in length ; dorsal spine 1¼ in head ; highest anal ray less than 2 in head. DASYCEPHALUS, 193.

*vv.* Head long, 3⅗ in length ; dorsal spine 1¾ in head ; highest anal ray 2⅓ in head. LONGICEPHALUS, 194.

TACHYSURUS : (genus 74.)

*nn.* Teeth on palate granular ; gill membranes not forming a free margin across the isthmus.

*w.* Anal rays 19 to 22 ; head broader than high, more than 3 in length.

*x.* Ventral fins blackish on inner margin ; axillary pore large ; groove of fontanelle scarcely reaching base of occipital process ; vomerine teeth small, the patches widely separated ; head 3½ in length. MELANOPUS, 200.

*xx.* Ventral fins pale ; axillary pore small; pectoral spine reaching at least halfway to middle of ventral ; occipital process little narrowed behind ; vomerine teeth course, the patches close together ; head 3⅔ in length. FÜRTHI, 201.

*ww.* Anal rays 27 ; teeth on palate in 2 small bands widely separated ; fontanelle long and narrow ; head rough. MULTIRADIATUS, 202.

## 69. GALEICHTHYS,* Cuvier & Valenciennes.

### 163. GALEICHTHYS LENTIGINOSUS (Eigenmann & Eigenmann).

Gill rakers 3 + 4. Color light brown, paler below, the sides freckled; head 4 to 4⅕. A. 22. Panama. (Eigenmann.) (*lentiginosus*, freckled.)

*Tachisurus lentiginosus*, EIGENMANN, Proc. Cal. Ac. Sci., 1888, 139, Panama.

### 164. GALEICHTHYS PERUVIANUS, (Lütken).

Gill rakers 3 + 10. Back and sides blue black; a conspicuous broad pale band along the lateral line. Head 3⅕. A. 14 to 16. Pacific Coast of Mexico to Peru, rather rare; this and the preceding species well marked by the skin-covered head, similar to that of species of *Felichthys*.

*Galeichthys peruvianus*, LÜTKEN, Vidensk. Med., 204, 1874, Callao.
*Tachisurus peruvianus*, EIGENMANN, S. A. Nematognathi, 51, 1890.

## 70. SCIADEICHTHYS, Bleeker.

### 165. SCIADEICHTHYS TROSCHELI, (Gill).

(BAGRE COLORADO.)

Body robust; dorsal plate longer than wide, its surface granular; granulations of head extending to above eye; occipital process short, emarginate behind; fontanelle large, ending acutely at a point nearer base of dorsal than tip of snout; upper caudal lobe 5 in length. Head 3⅐ to 3¼. A. 18. No axillary pore. Female as in some other species, with the head smoother and covered with thicker skin, as in the subgenus *Galeichthys*. Dark brown, with a brassy luster. Mazatlan to Panama, not rare; one of the largest species, used as food. (Named for Dr. Franz Hermann Troschel.)

*Sciades troscheli*, GILL, Proc. Ac. Nat. Sci. Phila., 1863, 171, Panama.
*Arius brandti*, STEINDACHNER, Ichth. Beitr., IV, 21, 1876, Altata; Panama.
*Tachisurus brandti*, EIGENMANN, S. A. Nematognathi, 55, 1890.

### 166. SCIADEICHTHYS EMPHYSETUS, (Müller & Troschel).

Closely allied to *S. troscheli*, of which it is the Eastern representative. Palatine bands of teeth with a backward projecting angle; teeth villiform; posterior nostrils not connected by membrane. Eye moderate, 5 in the interocular space, 11 in head. Maxillary barbels flattened, reaching middle or end of dorsal fin. Dorsal plate pointed in front, entering the notched occipital process; as wide as long, its surface pitted. Granulations of the head extending to above middle of cheeks. An elongate patch of teeth behind each palatine patch. Caudal deeply forked, the upper lobe 3⅔ in the length. Head 3⅗. Depth 6. D. 17; A. 18. Yellowish brown, paler below. Surinam. (Eigenmann.) (ἐμφυσάω, to inflate.)

*Bagrus (Sciades) emphysetus*, MÜLLER & TROSCHEL, Horæ Ichthyol., III, 8, 1849, Surinam.
*Arius emphysetus*, GÜNTHER, Cat., V, 150, 1864.
*Tachisurus emphysetus*, EIGENMANN, S. A. Nematognathi, 53, 1890.

### 167. SCIADEICHTHYS TEMMINCKIANUS, (Cuvier & Valenciennes).

Palatine bands of teeth with a backward projecting angle on the inner margin; teeth on palate villiform or nearly so. Dorsal plate pointed in front, entering the notched occipital process, ½ as wide as the skull behind the eye; surface of the bones striate rather than granulate. Eye small, 6 to 7 in the interorbital. Maxillary barbels reaching tips of ventrals. D. I, 6; A. 21. (Cuvier & Valenciennes.) Cayenne. Like the next, known only from the original description, both apparently allied to *S. troscheli*. (Named for C. J. Temminck, then director of the Museum of Holland.)

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* For the characters of this and other genera related to *Tachysurus* see the analysis above.

*Bagrus temminckianus*, CUVIER & VALENCIENNES, XIV, 463, 1839, Cayenne.
*Arius temminchii*, GÜNTHER, Cat., v, 151, 1864, after Cuvier & Valenciennes.
*Tachisurus temminckianus*, EIGENMANN, S. A. Nematognathi, 53, 1890.

### 168. SCIADEICHTHYS FLAVESCENS, (Cuvier & Valenciennes).

Palatine bands of teeth with a backward projection on the inner margin. Dorsal plate enlarged, pointed in front, entering the notched occipital process; emarginate behind, as wide as the cranium behind eye; granulations not extending forward to eyes; opercle and humeral process striate, not granular. Eye very small, 9 in interorbital. Dorsal and pectoral spines granular, moderately serrate. Upper jaw little longer; palatine bands of teeth oval. Maxillary barbel extending to middle of pectoral. Ventral shorter than pectoral fins; adipose ⅓ less than anal fin. Upper caudal lobe little the longer D. I, 7; A. 18. (Cuvier & Valenciennes.) Cayenne. (*flavescens*, yellowish.)

*Bagrus flavescens*, CUVIER & VALENCIENNES, XIV, 462, 1839, Cayenne.
*Arius flavescens*, GÜNTHER, Cat., v, 151, 1864.
*Tachisurus flavescens*, EIGENMANN, S. A. Nematognathi, 53, 1890.

### 169. SCIADEICHTHYS MESOPS, (Cuvier & Valenciennes).

Palatine teeth villiform, the band with a backward projection; posterior nostrils not connected by membrane. Dorsal plate enlarged, notched in front, receiving the point of occipital process. Eye midway between snout and preopercle; occipital process twice as long as broad, its tip mucronate, corresponding to a notch in the dorsal plate; top of head granulated to front of eyes; opercle granulated superiorly; humeral process as long as high, strongly granulated. Ventrals as long as pectorals. D. I, 7; A. 18. (Cuvier & Valenciennes.) Guiana. (*μέσος*, middle; ὤψ, eye.)

*Bagrus mesops*, CUVIER & VALENCIENNES, XIV, 456, 1839, Guiana.
*Arius mesops*, GÜNTHER, Cat., v, 145, 1864.
*Tachisurus mesops*, EIGENMANN, S. A. Nematognathi, 57, 1890.

### 170. SCIADEICHTHYS PROOPS, (Cuvier & Valenciennes).

Head 4 to 4⅓; depth, 7. D. I, 7; A. 18. Palatine bands of teeth with a backward projecting angle; posterior nostrils not connected by membrane; dorsal plate large, butterfly shaped, notched in front, receiving the point of occipital process; bones of head coarsely granular. Eye nearer snout than to preopercle, 1¼ in snout, about 3 in interorbital. Jaws subequal; occipital process broader than long, mucronate at tip; opercle striate. Body slender and elongate; head depressed; teeth on roof of mouth in 6 contiguous patches. Caudal deeply forked, the longer upper lobe 4¼ in body; pectoral spine 1¼ in head. Plumbeous above, with blue luster; fins dotted with brown. (Eigenmann.) West Indies from Porto Rico to Surinam and south to Pernambuco. (*πρό*, before; *ὤψ*, eye.)

*Bagrus proops*, CUVIER & VALENCIENNES, XIV, 457, 1839, Guiana; Porto Rico.
*Arius proops*, GÜNTHER, Cat., V, 148, 1864.
*Netuma proops*, BLEEKER, Silures de Suriname, 62, 1864.
*Tachisurus proops*, EIGENMANN, S. A. Nematognathi, 57, 1890.

### 171. SCIADEICHTHYS PASSANY, (Cuvier & Valenciennes).

D. I, 7; A. 17. Palatine patches of teeth with a backward projecting angle; dorsal plate notched in front, receiving the point of occipital process. Eye nearer snout than to preopercle. Lower jaw longer; occipital process wider and shorter than in *S. proops*, its tip reduced; dorsal plate more or less crescent-shaped. Eye nearer snout than in *S. proops*. Head flat, especially forward; opercle strongly granular; humeral process obtuse, higher than long, granular; dorsal and pectoral spine granular in front, weakly serrate behind; ventrals longer than pectorals. (Cuvier & Valenciennes.) Cayenne. (*passany*, the vernacular name at Cayenne.)

*Bagrus passany*, CUVIER & VALENCIENNES, XIV, 458, 1839, Cayenne.
*Arius passany*, GÜNTHER, Cat., V, 149, 1864.
*Tachisurus passany*, EIGENMANN, S. A. Nematognathi, 58, 1890.

### 172. SCIADEICHTHYS ALBICANS, (Cuvier & Valenciennes).

D. I, 7; A. 19. Palatine bands of teeth with an angle behind, the teeth villiform; dorsal plate notched in front, receiving the point of occipital process. Eye nearer snout than to preopercle. Jaws equal; dorsal plate large, almost as wide as the skull behind eye; opercle striate; top of head granular forward to between eyes; a triangular smooth area in front; humeral process, dorsal plate, and outer margins of dorsal and pectoral spines granular. Snout 3 in space from eye to preopercle; eye 5 in interocular space. Maxillary barbels scarcely reach gill opening. Adipose almost as long as anal. Caudal lobes subequal, 5½ in the total length. Head 4⅔ in the total, its width 1½ in its length. (Cuvier & Valenciennes.) Guiana to the Amazon. (*albicans*, whitish.)

*Bagrus albicans*, CUVIER & VALENCIENNES, XIV, 461, pl. 420, 1839, Cayenne.
? *Bagrus valenciennesi*, CASTELNAU, Anim. Amer. Sud., 31, pl. XIII, f. 1, 1855, Amazon.
*Arius valenciennesi*, GÜNTHER, Cat., V, 150, 1864.
*Tachisurus albicans*, EIGENMANN, S. A. Nematognathi, 59, 1890.

## 71. SELENASPIS, Bleeker.

### 173. SELENASPIS HERZBERGII, (Bloch).

Head 3⅗ to 3¾; depth, 5 to 6. D. I, 7; A. 18. Palatine bands of teeth with a backward projecting angle; teeth all villiform. Posterior nasal openings connected by a membrane; dorsal plate and occipital process truncate where they meet, at least in the adult; in the young the dorsal plate is somewhat convex in front, the backward projecting angles of the palatine patches not developed. Occipital process ½ as wide at tip as at base; its length more than ½ its width; its middle scarcely keeled; gill rakers 5 + 10. Body elongate, the head longer than wide; plates on head granular; fontanelle not continued behind the eyes and without backward projecting groove. Plumbeous above, sides silvery, fins dusky. (Eigenmann.) Coasts of South America from Cayenne to Para; common. (Named for Herzberg.)

*Silurus herzbergii*, Bloch, Ichthyol., VIII, 33, pl. 367, 1801, Surinam.
*Arius herzbergii*, Günther, Cat., v, 144, 1864.
*Tachisurus herzbergii*, Eigenmann, S. A. Nematognathi, 59, 1890.
*Pimelodus argenteus*, Lacépède, Hist. Nat. Poiss., v, 94, 1803, Surinam.
*Bagrus pemecus*, Cuvier & Valenciennes, XIV, 456, 1839, Cayenne.
*Bagrus cœlestinus*, Müller & Troschel, Horæ Ichth., III, 7, 1849, Guiana.
*Hexanematichthys hymenorhinus*, Bleeker, Silures de Suriname, 57, pls. XI and XIII, 1864, Surinam.

### 174. SELENASPIS DOWI, (Gill).

Head 3¼ in length. Gill rakers 7 + 15; A. 16. Dorsal shield and occipital process truncate, the former much broader than long, the latter very short; the length of occipital process not ½ its greatest width; fontanelle short, ending obtusely at a point much nearer tip of snout than front of dorsal. Young with dorsal shield reduced, vomerine bands separated and the backward prolongation of palatine bands obscure. Panama to Guayaquil. (Named for Capt. John M. Dow.)

*Leptarius dowi*, Gill, Proc. Ac. Nat. Sci. Phila., 1863, 170, Panama.
*Arius alatus*, Steindachner, Ichth. Beitr., IV, 19, 1876, Panama.
*Arius dowi*, Jordan & Gilbert, Bull. U. S. Fish Com., 1881, 37.
*Tachisurus dowi*, Eigenmann, S. A. Nematognathi, 61, 1890.

### 175. SELENASPIS LUNISCUTIS, (Cuvier & Valenciennes).

Head 3⅗; depth 5½ to 6. D. I, 7; A. 16 to 19. Palatine bands of teeth with a backward projection. Teeth in jaws coarse, conical; those on vomer and palate finely granular. The patches separate in young, but united and covering most of roof of mouth in adult. Margin of dorsal plate and of occipital process convex where they meet; palatine patches of teeth connected by the vomerine patch in front, their inner margins not touching behind. Body rather stout. Head large, flattish above; top of head coarsely granular in young, becoming more finely granular with age. Occipital process broader than long. Dorsal plate large, saddle-shaped, broader than long or longer than broad. Fontanelle crossed by 2 or 3 bony bridges, the middle portion more than ½ its total length. Barbels short. Purplish brown, with brown dots below. (Eigenmann.) Surinam to Rio Janeiro; common. (*luna*, moon; *scutum*, shield.)

*Arius luniscutis*, Cuvier & Valenciennes, XV, 109, 1840, Brazil.
*Arius luniscutis*, Günther, Cat., v, 152, 1864.
*Tachisurus luniscutis*, Eigenmann, S. A. Nematognathi, 63, 1890.

### 176. SELENASPIS PARKERI, (Traill).

(Bresson.)

Allied to *S. luniscutis*; the teeth on the palate granular. Dorsal plate large, emarginate in front, receiving the pointed occipital process; palatine patches either separate or united for their whole length. (Bleeker.) Muddy river mouths, Guiana to Para. (Named for Mr. Parker.)

*Silurus parkeri*, TRAILL, Mem. Werner. Soc., 1832, VI, 377, pl. 6, Guiana.
*Arius parkeri*, GÜNTHER, Cat., V, 153, 1864.
*Tachisurus parkeri*, EIGENMANN, S. A. Nematognathi, 65, 1890.
*Arius quadriscutis*, CUVIER & VALENCIENNES, XV, 111, 1840, Cayenne; Mana.
*Netuma quadriscutis*, BLEEKER, Silures de Suriname, 59, 1864, with plates.

## 72. NETUMA, Bleeker.

### 177. NETUMA GRANDICASSIS, (Cuvier & Valenciennes).

Head 3⅖ to 3¾; depth 5⅜ to 6. D. I, 7; A. 18. Dorsal plates cresent-shaped, not enlarged. Occipital process shaped like a clover leaflet, emarginate at tip, narrowly and deeply constricted at base, its margins regularly and strongly convex; its middle keeled or not; its length not much greater than its breadth. Body cylindrical in front, tapering behind. Head greatly depressed, longer than broad; center of fontanelle over middle of eye, not continued backward as a groove; interorbital region with 4 ridges; upper jaw considerably projecting; lip wide; vomerine teeth in small patches or wanting; palatine patches triangular, produced backward. Guiana to Bahia. (Eigenmann.) (*grandis*, large; *cassis*, helmet.)

*Arius grandicassis*, CUVIER & VALENCIENNES, XV, 53, pl. 427, 1840, Guiana?
*Arius grandicassis*, GÜNTHER, Cat., V, 153, 1864.
*Tachisurus grandicassis*, EIGENMANN, S. A. Nematognathi, 65, 1890.

### 178. NETUMA STRICTICASSIS, (Cuvier & Valenciennes).

Entirely similar to *N. grandicassis*, but with the occipital process much narrowed, its margins scarcely convex, and its length 2 or 3 times its greatest breadth. The form of this process varies, so that Eigenmann regards this form as a variety of *N. grandicassis*, another subspecies (*parmocassis*, Cuvier & Valenciennes, from Bahia), being intermediate between the two. Surinam to Bahia. (Eigenmann.) (*strictus*, narrowed; *cassis*, helmet.)

*Arius stricticassis*, CUVIER & VALENCIENNES, XV, 58, 1840, Cayenne.
*Arius stricticassis*, GÜNTHER, Cat., V, 154, 1864.
*Tachisurus grandicassis stricticassis*, EIGENMANN, S. A. Nematognathi, 68, 1890.

### 179. NETUMA DUBIA, (Bleeker).

Head 4⅓ to 4⅙ in length; eye 4 to 4¾ in head, 1⅓ to 1⅔ in interocular space; body little broader than high; caudal compressed; head depressed, acute, its width 1¼ to 1⅕ in its length; width of mouth 2⅓ to 2⅕. D. I, 7; A. 18 to 20. Dorsal plate, crescent shaped, not enlarged. Palatine bands of teeth without backward extension. Teeth villiform. Occipital process widest at its base. Interorbital region granular, or if smooth, the fontanelle without a groove. Posterior nasal openings not connected by a membrane. Fontanelle not produced backward as a groove. Maxillary barbels reaching to base of ventrals. Occipital process keeled, not much longer than broad; snout scarcely longer than eye, depressed, a large axillary pore; dorsal spine 1¼ in head, granulated on its basal half in front, striate on sides, slightly serrate behind; adipose longer than dorsal fin, twice as long as high; pectoral spine broader but not longer than dorsal spine, its inner margin conspicuously serrated; ventrals much shorter than pectorals; anal as high as long; caudal 4⅗ to 6 in the length. Surinam. (Bleeker.) (*dubius*, doubtful.)

*Netuma dubia*, Bleeker, Versl. Med. Ac. Wet. Amsterd., xiv, 382, 1862, Surinam.
*Arius dubius*, Günther, Cat., v, 144, 1864.
*Tachisurus dubius*, Eigenmann, S. A. Nematognathi, 69, 1890.

### 180. NETUMA KESSLERI, (Steindachner).

Head large, 3½; caudal not ⅔ head; fontanelle obtuse behind. A. 17. Shields of head coarsely granular; barbels short, reaching base of pectorals. Altata to Panama; not rare. (Named for Dr. K. P. Kessler, author of the Ichthyology of Turkestan.)

*Arius kessleri*, Steindachner, Ichth. Beitr., iv, 24, 1876, Altata; Panama.
*Arius kessleri*, Jordan & Gilbert, Bull. U. S. Fish Comm., 1882, 40.
*Tachisurus kessleri*, Eigenmann, S. A. Nematognathi, 69, 1890.

### 181. NETUMA INSCULPTA, (Jordan & Gilbert).

Head 4. A. 18. Eye 6½ in head; Fontanelle gradually narrowd behind, becoming a narrow groove nearly reaching occipital process; dorsal and pectoral spines subequal, 1⅓ in head; fins pale. Panama. (*insculptus*, sculptured.)

*Arius insculptus*, Jordan & Gilbert, Bull. U. S. Fish Com., 1882 (1883), 41, Panama.

### 182. NETUMA PLANICEPS, (Steindachner).

Head 3¾ to 4. A. 17. Shields of head rather coarsely granular; barbels very short, scarcely reaching pectoral; caudal a little shorter than head; interorbital area flat and smooth; fins dusky. Altata to Panama; not rare. (*planus*, flat; *-ceps*, head.)

*Arius planiceps*, Steindachner, Ichth. Beitr., iv, 26, 1876, Altata; Panama.

### 183. NETUMA PLATYPOGON, (Günther).

Head 3⅗. A. 18. Shields of head finely and irregularly granular, the granules not in lines. Inner margins of palatine patches of teeth straight; fontanelle continued abruptly backward as a groove; anterior margin of dorsal spine sharply serrate; body rather elongate, the top of head with an unusually large smooth area. Gulf of California to Peru; generally common. (πλατύς, broad; πώγων, beard, the barbels being widened at base.)

*Arius platypogon*, Günther, Cat., v, 147, 1864, San Jose de Guatemala.
*Arius platypogon*, Jordan & Gilbert, *l. c.*, 44, 1882.
*Tachisurus platypogon*, Eigenmann, S. A. Nematognathi, 71, 1890.

### 184. NETUMA OSCULA, (Jordan & Gilbert).

Head 3⅞. A. 18. Mouth small, with thick lips; occipital process narrow, its edges almost parallel until abruptly widened at base; median keel well developed; fontanelle broad and shallow, becoming a narrow groove behind, nearly reaching occipital process. Shields coarsely and sparsely granular; interorbital space nearly plane, with smooth ridges; barbels short; fins blackish. Panama; scarce. (*osculus*, diminutuve of *os*, mouth.)

*Arius osculus*, Jordan & Gilbert, *l. c.*, 1882, 46, Panama.
*Tachisurus osculus*, Eigenmann, S. A. Nematognathi, 74, 1890.

### 185. NETUMA ELATTURA, (Jordan & Gilbert).

Head 3⅔. A. 18. Mouth rather large; vomerine teeth rather coarse; palatine patches small; barbels rather short; occipital process short, broadly triangular, with concave sides, the base abruptly broadened: median keel well developed; fontanelle broad and shallow, with a narrow groove behind, nearly reaching occipital process; shields roughish, but smoother than in *N. kessleri;* barbels rather short; caudal short, 1⅗ in head. Panama; scarce. (*ἐλάττων*, reduced; *οὐρά*, tail.)

*Arius elatturus*, JORDAN & GILBERT, *l. c.*, 45, 1882, Panama.

## 73. HEXANEMATICHTHYS, Bleeker.

### 186. HEXANEMATICHTHYS FELIS, (Linnæus).

(SEA CATFISH.)

Head 3¾; depth 5. D. I, 7; P. I, 6; A. 16. Body rather elongate, not compressed, tapering into the slender tail; head subconic, depressed, flattish above; maxillary barbel nearly as long as the head; gill membranes broadly united, forming a narrow, free fold across the isthmus; occipital process with a median keel, long, about ⅓ head, its tip convex; fontanelle forming a narrow groove; top of head comparatively smooth; humeral process nearly ½ the length of the pectoral spine; caudal deeply forked, the upper lobe the longer. Steel blue, sides and belly silvery. lower fins pale. L. 24 inches. Cape Cod to Texas; common southward along the sandy coast, the most abundant of the salt-water catfishes on the United States coast, and the only one of the *Tachysurus* type found much north of the Tropic of Cancer. (*felis*, cat.)

*Silurus felis*, LINNÆUS, Syst. Nat., Ed. XII, 503, 1766, Charleston, S. C.
*Arius milberti*, CUVIER & VALENCIENNES, XV, 74, 1840, New York; Charleston.
*Arius milberti*, GÜNTHER, Cat., V, 155, 1864.
*Arius equestris*, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1855, 26, Indianola, Texas.
*Arius equestris*, GÜNTHER, Cat., V, 173, 1864.
*Arius felis* and *equestris*, JORDAN & GILBERT, Synopsis, 110, 1883.

### 187. HEXANEMATICHTHYS SEEMANI, (Günther).

Head 3¾. A. 18. Head flat, depressed in front, its shields coarsely granular; occipital process wider than long, with a bluntish keel; fontanelle open to above the posterior margin of the eye, with a deep backward extending groove; barbels reaching slightly beyond base of pectorals; vomerine teeth in 2 small ovate patches; each joined to a larger palatine patch; axillary pore large; gill rakers 5 + 12. Paired fins dusky within. Panama. (Named for Dr. Seeman, who obtained the type.)

*Arius seemani*, GÜNTHER, Cat., V, 147, 1864, "Central America."
*Tachisurus seemani*, EIGENMANN, S. A. Nematognathi, 78, 1890.

### 188. HEXANEMATICHTHYS JORDANI, (Eigenmann & Eigenmann.)

Head 3½. A. 18. Rather robust; interorbital area flat and smooth; shields of head finely and sparsely granular; opercle smooth; occipital process about as long as head, with an unusually sharp keel; fontanelle continued as a deep groove to base of occipital process; maxillary barbels reaching axil; snout blunt; vomerine teeth in 2 small, separate patches, contiguous to the larger palatine patches; gill rakers 6 + 9. Caudal deeply forked. Inner surface of paired fins black. Panama; two specimens known. (Named for David Starr Jordan.)

*Tachisurus jordani*, EIGENMANN & EIGENMANN, Proc. Cal. Ac. Sci., 1888, 142, Panama; EIGENMANN, S. A. Nematognathi, 79, 1890.

### 189. HEXANEMATICHTHYS CÆRULESCENS, (Günther).

Head $3\frac{1}{2}$ to $3\frac{3}{5}$. A. 17. Palatine patches of teeth small, scarcely larger than the vomerine patches which are oval and widely separated on median line; occipital process broader than long; head $\frac{3}{4}$ as wide as long; eye $6\frac{1}{2}$ in head, 2 in snout, 3 in interorbital width; maxillary barbels to middle of pectorals; occipital process keeled, subtruncate posteriorly; dorsal spine 2 in head; pectoral spine equal to head without snout; upper caudal lobe about as long as head. Steel blue; fins largely black. West coast of Guatemala. (Günther.) (Latin, bluish.)

*Arius cærulescens*, GÜNTHER, Cat., v, 149, 1864, Rio Huamuchal, Guatemala.

### 190. HEXANEMATICHTHYS GUATEMALENSIS, (Günther).

Head $3\frac{5}{7}$. A. 18. Palatine patches of teeth much larger than vomerine; fontanelle almost obsolete, ending between the eyes, and not prolonged into a groove; head $\frac{2}{3}$ as wide as long; body slender; fins mostly dusky; caudal about as long as head; body slender. Mazatlan to Central America; not rare.

*Arius guatemalensis*, GÜNTHER, Cat., v, 145, 1864, Guatemala; Chiapas.
*Arius guatemalensis*, JORDAN & GILBERT, *l. c.*, 48, 1882.

### 191. HEXANEMATICHTHYS ASSIMILIS, (Günther).

Fontanelle short and narrow, ending midway between tip of snout and middle of dorsal plate; head $\frac{3}{4}$ as wide as long. D. I, 7; otherwise essentially as in *H. guatemalensis*. (Günther). Atlantic coast of Central America, ascending streams. (*assimilis*, similar.)

*Arius assimilis*, GÜNTHER, Cat., v, 146, 1864, Lake Yzabal, Guatemala.
*Arius assimilis*, JORDAN, Proc. Ac. Nat. Sci. Phila., 1883, 281.

### 192. HEXANEMATICHTHYS SURINAMENSIS, (Bleeker).

Head $3\frac{3}{5}$; depth 6. D. I, 7; A. 18. Palatine bands of teeth without backward projecting angle; teeth all villiform, those on the palate in 4 patches, the vomer and palatine patches sometimes contiguous. Granulations of the head continued forward to between the eyes. Fontanelle not continued backward as a groove; interorbital area without ridges; adipose fin about as high as long, shorter than the dorsal fin. Depth of head $1\frac{5}{6}$ in its length; width $1\frac{1}{3}$. Eye $5\frac{1}{6}$ in the head, $2\frac{1}{6}$ in the interocular, less than 2 in snout. Occipital process not longer than broad, not conspicuously keeled. Snout depressed; upper jaw little longer than lower. Vomer and palatine teeth contiguous. Maxillary barbels reaching to the base of the pectorals. Opercle smooth. Dorsal spine shorter than the pectoral spine, about 2 in the head, granulated in front, striated on sides; caudal 4 in length Surinam. (Bleeker).

*Hexanematichthys surinamensis*, Bleeker, Versl. Med. Akad. Wet. Amsterd., 380, 1862, **Surinam.**
*Arius surinamensis*, Günther, Cat., v, 148, 1864.
*Tachisurus surinmensis*, Eigenmanm, S. A. Nematognathi, 81, 1890.

### 193. HEXANEMATICHTHYS DASYCEPHALUS, (Günther).

Head 4½. A. 21. Interorbital area with 4 very rough granulated ridges; (smoother in ♀); shields of head coarsely granular; vomerine and palatine teeth on each side confluent in a small roundish patch; gill membranes not forming an angle; fontanelle continued backward as a groove to base of occipital process; spines high; the dorsal 1¼ in head. Fins blackish. Panama (wrongly ascribed to the Hawaiian Islands). (*δασύς*, rough; *κεφαλή*, head.)

*Arius dasycephalus*, Günther, Cat., v, 1864, 157, **Oahu**, apparently an error.
*Arius dasycephalus*, Jordan & Gilbert, *l. c.*, 51, 1882.

### 194. HEXANEMATICHTHYS LONGICEPHALUS, Eigenmann & Eigenmann.

Head 3⅗. A. 20. Allied to *H. dasycephalus*, but with the granular ridges on the head largely obscured by thick skin; occipital process as long as broad, its margins concave; fontanelle produced as a deep groove; barbels short; gill rakers short and thick, 4 + 5; spines short; fins dusky. Panama. (Eigenmann.) (*longus*, long; *κεφαλή*, head.)

*Tachisurus longicephalus*, Eigenmann & Eigenmann, Proc. Cal. Ac. Sci., 1888, 143, **Panama**; Eigenmann, S. A. Nematognathi, 82, 1890.

### 195. HEXANEMATICHTHYS RUGISPINIS, (Cuvier & Valenciennes).

Head 3½ to 4; depth 5½ to 6. D. I, 7; A. 19 to 21. Palatine bands of teeth not continued backward; teeth all villiform. Teeth on the palate in 2 patches. Eye small, about 10 in the length of the head; fontanelle not continued as a groove. Sides of the dorsal and pectoral spines granular; fontanelle angular behind, its posterior portion separated by a bridge and not ending in a groove; interorbital region with 4 ridges; intermaxillary band of teeth 4 times as wide as deep; palatine patches of teeth less than diameter of eye in width. Barbels villiform, the maxillary barbel reaching beyond base of pectoral; mouth inferior, the lips thick; no axillary pore. Body slender; head broad, depressed. Surinam to Para. (Eigenmann.) (*ruga*, wrinkle or roughness; *spina*, spine.)

*Arius rugispinis*, Cuvier & Valenciennes, xv, 77, 1840, **Cayenne.**
*Arius rugispinis*, Günther, Cat., v, 156, 1864.
*Tachisurus rugispinis*, Eigenmann, S. A. Nematognathi, 83, 1890.

### 196. HEXANEMATICHTHYS PHRYGIATUS, (Cuvier & Valenciennes).

This species or variety is very close to *H. rugispinis*, differing as follows: Teeth on the palate in 2 patches. Eye small, about 10 in the length of the head; fontanelle not continued as a groove. Sides of the dorsal and pectoral spines striate; fontanelle broadly rounded behind; intermaxillary band of teeth 6 times as wide as deep; palatine patches 1½ diameters of eye in width and length. (Eigenmann.) Surinam to Maranhão. This form is regarded by Eigenmann as a subspecies of the preceding. As the two inhabit the same waters, *phrygiatus* should be either a distinct species or an extreme of individual variation. (*phrygiatus*, embroidered in gold.)

*Arius phrygiatus*, Cuvier & Valenciennes, xv, 79, 1840, Cayenne.
*Arius phrygiatus*, Günther, Cat., v, 156, 1864.
*Tachisurus rugispinis phrygiatus*, Eigenmann, S. A. Nematognathi, 84, 1890.

## 74. TACHYSURUS, Lacépède.

### 197. TACHYSURUS NUCHALIS, (Günther).

Head 4; depth 5. D. I, 7; A. 21. Teeth on palate large, granular; no teeth on vomer; occipital process triangular, as long as broad, obtusely keeled; groove of fontanelle not reaching base of occipital process; palatine teeth in 2 subtriangular patches which sometimes meet in front; maxillary barbels nearly reaching tip of pectorals. Dorsal spine slightly serrated on both edges 1⅕ in head; adipose fin shorter than dorsal; pectoral spine as long as dorsal spine and stronger. Guiana. (Günther.) (*nuchalis*, pertaining to the nape.)

*Arius nuchalis*, Günther, Cat., v, 171, 1864, British Guiana.
*Tachisurus nuchalis*, Eigenmann, S. A. Nematognathi, 86, 1890.

### 198. TACHYSURUS FISSUS, (Cuvier & Valenciennes).

Head 3 in length; maxillary barbels reaching almost to the middle of the pectoral fin. Teeth on the palate granular; no teeth on vomer; gill membrane not forming a free margin across the isthmus. Head broader than high. Soft portions of the head not pitted. Surinam. (Eigenmann.) (*fissus*, split.)

*Arius fissus*, Cuvier & Valenciennes, xv, 107, 1840, Cayenne.
*Arius fissus*, Günther, Cat., v, 172, 1864.
*Tachisurus fissus*, Eigenmann, S. A. Nematognathi, 88, 1890.
*Arius puncticulatus*, Cuvier & Valenciennes, xv, 108, 1840, Buenos Ayres.

### 199. TACHYSURUS SPIXII, (Agassiz).

Head 3⅗ to 4; depth 5 to 5½. D. I, 7; A. 21. Palatine bands without backward prolongation. Teeth on the palate, granular; no teeth on vomer; gill membrane not forming a free margin across the isthmus. Head broader than high, more than 3 in the length. Axillary pore much smaller than nasal opening. Pectoral spine reaching halfway to the posterior third of the ventrals, or shorter; upper jaw projecting; posterior margin of the eye about in the middle of the head. Occipital process greatly narrowed behind, its width at tip not more than ½ diameter of eye. Teeth on the palate large, granular, 20 or fewer, some of the posterior ones usually much enlarged. Body compressed; head narrowed forward, fontanelle narrow; not interrupted, continued as a deep tapering groove to near base of occipital process. Maxillary barbels variable, long. Brownish above, silvery below, sometimes dotted. Coast of Guiana and Brazil, south to Santos; common. (Named for Jean Baptiste Spix, of Munich, explorer in Brazil.)

*Pimelodus albidus*, SPIX, in Agassiz, Gen. Spec. Pisc. Brasil, 19, 1829, Equatorial Brazil; name preoccupied.
*Pimelodus spixii*, AGASSIZ, Gen. Spec. Pisc. Brasil, 19, 1829, after Spix.
*Tachisurus spixii*, EIGENMANN, S. A. Nematognathi, 88, 1890.
*Arius arenatus*, CUVIER & VALENCIENNES, XV, 106, 1840, Cayenne.
*Arius arenatus*, GÜNTHER, Cat., V, 172, 1864.
*Arius laticeps*, GÜNTHER, Cat., V, 171, 1864, British Guiana; Trinidad.

### 200. TACHYSURUS MELANOPUS, (Günther).

Head 4⅓. P. 10; A. 21. Palatine teeth, bluntish conical; axillary pore large. Dorsal spine as long as from front of eye to gill opening; pectoral spine nearly as long; shields of head finely granular; groove of fontanelle not quite reaching occipital process; orbital rim of eye not free above; fins all more or less blackish; inner surface of ventral blackish. Both coasts of Central America; Rio Motagua (Günther); Panama (Steindachner). Our specimens from Rio Ahome, on the west coast of Mexico, above Mazatlan; the original specimens from the east slope of Guatemala. It is possible that the Pacific Coast form may be different from the original *melanopus*. According to Günther, the axillary pore in *melanopus* is nearly as large as the nostril. In our specimens the pore is much smaller than the nostril. (μέλας, black; πούς, foot or ventral fin.)

*Arius melanopus*, GÜNTHER, Cat., V, 172, 1864, Rio Motagua.

### 201. TACHYSURUS FÜRTHII, (Steindachner).

Head 3½; A. 25. Palatine teeth granular, coarser than in *T. melanopus;* pectoral spine reaching at least halfway to middle of ventrals; jaws subequal; occipital process not greatly narrowed behind; gill rakers long and slender, 4 + 11; gill membranes united to isthmus, without free margin; axillary pore small. (Eigenmann.) Panama. (For Ignatius Fürth, Austrian consul at Panama.)

*Arius fürthii*, STEINDACHNER, Ich. Beitr., IV, 29, 1876, Panama.
*Tachisurus fürthii*, EIGENMANN, S. A. Nematognathi, 90, 1890.

### 202. TACHYSURUS VARIOLOSUS, (Cuvier and Valenciennes).

A. 22 or 23. Teeth on the palate granular, the patches without backward projection; no teeth on vomer; gill membrane not forming a free margin across the isthmus. Head broader than high; soft portions of the head pitted; length of head to end of occipital process little less than 3 in the length, granular portion ⅕ longer than smooth portion of the head. Fontanelle not continued as a groove. Maxillary barbels extending beyond middle of pectorals. Cayenne. (Cuvier & Valenciennes.) (*variolosus*, pock-marked.)

*Arius variolosus*, CUVIER & VALENCIENNES, XV, 107, 1840, Cayenne.
*Arius variolosus*, GÜNTHER, Cat., V, 173, 1864.
*Tachisurus variolosus*, EIGENMANN, S. A. Nematognathi, 92, 1890.

### 203. TACHYSURUS MULTIRADIATUS, (Günther).

Head 4 in total length; depth 5¾. D. I, 7; A. 27 (5, 22). Barbels short, not reaching gill openings; teeth on palate granular, paved, in 2 small bands, widely separated on median line; fontanelle long and narrow, reaching almost to occipital process; bones of head roughly granular and sculptured; occipital process as long as broad; fins pale. Rio Bayano, near Panama. An ally of *T. fürthii*, apparently distinguished by the longer anal fin. (Kner.) (*multus*, many; *radiatus*, rayed.)

*Bagrus arioides*, KNER, Sitzber. Akad. Wiss., München, 1863, 227, not of Cuvier & Valenciennes; and KNER & STEINDACHNER, Bayer Akad., 1864, 47.

*Arius multiradiatus*, GÜNTHER, Cat., v, 173, 1864; (after Kner), Rio Bayano.

### 75. CATHOROPS, Jordan & Gilbert.

*Cathorops*, JORDAN & GILBERT, Bull. U. S. Fish Comm., 1882, 54, (*hypophthalmus*).

This group is closely allied to the typical section or genus of *Tachysurus*. It is distinguished chiefly by the slender and numerous gill rakers and by the low insertion of the eyes, suggesting the genus *Hypophthalmus*. The two species are American. (καθοράω, to look down; ὤψ, eye.)

*a.* Upper jaw much produced; breadth of mouth 2½ in head. HYPOPHTHALMUS, 204.
*aa.* Upper jaw scarcely produced; breadth of mouth 2 in head. GULOSUS, 205.

#### 204. CATHOROPS HYPOPHTHALMUS, (Steindachner).

Head 3⅖. A. 22. Body elongate; head long, narrow, depressed; palantine teeth small, bluntly conic, almost granular; vomerine bands widely separate, each confluent with the large palatine band, which is not produced backward; both jaws thin, depressed, with narrow bands of teeth; barbels very long; the maxillary reaching near middle of pectoral spine; dorsal spine long; pectoral shorter; dorsal shield small; occipital process subtriangular, longer than broad, its sides concave, its middle angular but not keeled; fontanelle long and narrow, not quite reaching occipital process; shields of head rugose, with reticulating furrows. Fins mostly pale. Eye small, placed low, its middle below level of angle of mouth. L. 14 inches. Panama, rather scarce. (ὑπό, below; ὀφθαλμός, eye.)

*Arius hypophthalmus*, STEINDACHNER, Ichth. Beitr., IV, 31, pl. X, 1875, Panama.

#### 205. CATHOROPS GULOSUS, (Eigenmann & Eigenmann).

Head 3¼. A. 23. Body slender; head broad, depressed; width of head 1½ in its length; occipital process about as broad as long, obtusely keeled; fontanelle narrow, continued backward as a groove; bones of head rugose; eye oblique, its center over posterior end of mandible, on level of angle of mouth; barbels reaching nearly to middle of pectoral; jaws very thin; no vomerine teeth; palatine teeth widely separated, in very narrow bands, the teeth obtusely conical; gill membranes united, with free margin. Gill rakers 12 + 30, 1½ times diameter of eye; pectoral pore large; spine slender, rather long. Panama. (Eigenmann.) (*gulosus*, large-mouthed.)

*Tachisurus gulosus*, EIGENMANN & EIGENMANN, Proc. Cal. Ac. Sci., 1888, 146, Panama; EIGENMANN, S. A. Nematognathi, 93, 1890.

### 76. ICTALURUS, Rafinesque.

(CHANNEL CATS.)

*Ictalurus*, RAFINESQUE, Ichth. Oh., 61, 1820, (*maculatus=punctatus*).

*Elliops*, RAFINESQUE, *l. c.*, 61, (*maculatus*).

*Synechoglanis*, GILL, Ann. Lyc. Nat. Hist. N. Y., 1859, 39, (*beadlei=punctatus*).

Body elongate, slender, compressed posteriorly. Head slender and conical. Supraoccipital bone or process prolonged backward, its emarginated apex receiving the acuminate anterior point of the second interspinal, thus forming a continuous bony bridge from the head to the dorsal spine. Mouth small, terminal, the upper jaw longer. Teeth subulate, in a short band on each jaw. Dorsal fin high, with one long spine, and usually 6 rays. Adipose fin over posterior portion of anal. Anal fin long, with 25 to 35 rays. Ventral fins each with 1 simple and 7 branched rays. Pectoral fins each with a stout spine, retrorse serrate within, and about 9 rays. Caudal fin elongate, deeply forked, the lobes pointed, the upper the longer. Coloration pale or silvery. Fresh waters of North America; 3 species known; the best of the Catfishes as food. They are active fishes, frequenting especially river channels and ripples in large streams. (*ἰχθύς*, fish; *αἰλουρὸς*, cat; hence more correctly, *Ichthyælurus.*)

*a.* Anal fin very long, its base nearly ⅓ its body, its rays 32 to 35. FURCATUS, 206.

*aa.* Anal fin shorter, its rays 25 to 29.

*b.* Barbels long, extending considerably beyond gill opening; anal rays usually about 26. PUNCTATUS, 207.

*bb.* Barbels short, the longest only reaching gill opening; anal rays 28 or 29. MERIDIONALIS, 208.

### 206. ICTALURUS FURCATUS, (Le Sueur).

(CHUCKLE-HEADED CAT.)

Head small, about 4½ in length; depth 4 in adults to 5½ in young. Anal fin extremely elongate, its base nearly ⅓ the length of the body (without caudal); its rays 32 to 35 in number. Eye small, wholly anterior, the middle of the head being behind its posterior margin. Slope from dorsal to snout somewhat concave, especially in adults. Pectoral spine rather long; humeral spine stout, shortish, not reaching middle of pectoral spine. Skin thin. Color silvery, plain, or somewhat spotted. Size rather large, reaching a weight of over 40 pounds. Ohio to Iowa and Texas; not very common. (*furcatus*, forked.)

*Pimelodus furcatus*, LE SUEUR, in Cuvier & Valenciennes, IX, 136, 1840, New Orleans.

*Ictalurus furcatus*, JORDAN & GILBERT, Synopsis, 109, 1883.

*Amiurus furcatus*, GÜNTHER, Cat., V, 103, 1864.

*Pimelodus affinis*, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 26, Rio Grande. (Type, Nos. 837 and 838.)

### 207. ICTALURUS PUNCTATUS, (Rafinesque).

(CHANNEL CAT; WHITE CAT; BLUE CAT.)

Head 4; depth 5. Anal 25 to 30. Head rather small, narrow, convex above, so that the eye is little nearer the upper than the lower outline. Eye large, the middle point of the length of the head being near its posterior margin. Mouth small. Barbels long, the maxillary barbels reaching more or less beyond gill opening. Spines long. Humeral process long and slender, more than ½ the length of the pectoral spine, which is strongly serrated behind. Color light olivaceous above, the sides pale or silvery, and almost always with irregular small, round, dark spots; fins often with dark edgings. Body rather long and slender, back little elevated. Rivers of the Great Lake region and Mississippi Valley and streams tributary to the Gulf of Mexico; generally abundant in the channels of the larger streams, especially southwestward. It reaches a weight of 20 to 25 pounds, and is an excellent food fish, not inferior to the Black Bass. Variable. (*punctatus*, spotted.)

*Silurus punctatus*, RAFINESQUE, Amer. Month. Mag., 1818, 359, Ohio River.

*Ichthælurus punctatus*, JORDAN, Bull. U. S. Nat. Mus., x, 1877, 76.

*Pimelodus caudafurcatus*, LE SUEUR, Mém. Mus., v, 152, 1819, Wabash River, Mississippi River.

*Pimelodus cærulescens*, RAFINESQUE, Ichth. Oh., 63, 1820, Ohio River.

*Amiurus caudafurcatus*, GÜNTHER, Cat., v, 102, 1864.

*Pimelodus maculatus*, *pallidus*, *argentinus*, *argyrus*, with varieties *erythroptera*, *marginatus*, *lateralis*, *leucoptera*, RAFINESQUE, Quart. Jour. Sci. London, 1820, and Ichth. Oh., 62, etc., 1820, Ohio River.

*Pimelodus furcifer*, CUVIER & VALENCIENNES, xv, 139, 1840, Surinam, by error.

*Pimelodus gracilis*, HOUGH, Ann. Rept. Regents, Albany, 1852, 26, Somerville, N. Y.

*Pimelodus vulpes*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1858, 170, Rivers of Texas. (Type, Nos. 843, 845, and 846.)

*Synechoglanis beadlei*, GILL, Trans. Lyc. Nat. Hist. N. Y., 1859, 2, St. Catherines, Ontario. (Type, No. 5115.)

*Pimelodus houghi*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 159, Somerville; Ogdensburgh; Foxburg, Penn. (Type, No. 1532.)

*Pimelodus megalops*, GIRARD, *l. c.*, 161, Black Warrior River; Bigsby River, Alabama. (Type, No. 1532.)

*Pimelodus graciosus*, GIRARD, *l. c.*, 161, Prairie Mer Rouge, Louisiana. (Type, No. 1511.)

*Pimelodus hammondi* and *notatus*, ABBOTT, Proc. Ac. Nat. Sci. Phila., 1860, 568, Fort Riley.

*Ictalurus simpsoni*, GILL, Proc. Bost. Soc. Nat. Hist., 1862, 43, Platte River.

*Ictalurus robustus*, JORDAN, Bull. U. S. Nat. Mus., x, 1877, 76, Cairo, Illinois. (Type, No. 2056.)

### 208. ICTALURUS MERIDIONALIS, (Günther).

Head 5; depth 4. D. I, 6; A. 28 or 29. Similar to *I. punctatus*, but with the barbels shorter, the longest only reaching gill opening. Brownish above, with blue reflections, silvery below. Rio Usumacinta, Guatemala. (Günther.) (*meridionalis*, southern.)

*Amiurus meridionalis*, GÜNTHER, Cat., v, 1864, 102, and in Trans. Zoöl. Soc. Lond., 1868, 473, Rio Usumacinta, Guatemala.

## 77. AMEIURUS,[*] Rafinesque.

(HORNED POUT.)

*Ameiurus*, RAFINESQUE, Ichth. Oh., 65, 1820, (*cupreus*=*natalis*).

*Gronias*, COPE, Proc. Ac. Nat. Sci. Phila., 1864, 231, (*nigrilabris*).

*Haustor*, JORDAN AND EVERMANN, subgen. nov., (*lacustris*).

*Amiurus* or *Ameiurus*, corrected spelling.

Body moderately elongated, robust anteriorly, the caudal peduncle much compressed. Head large, wide; supraoccipital extended backward, terminating in a more or less acute point, which is entirely separate from the second interspinal buckler; skin covering the bones thick. Eyes rather small, but developed. Mouth large, the upper jaw in most species the longer. Teeth in broad bands on the premaxillaries and dentaries; band of upper jaw convex in front, of equal breadth, and without backward prolongation at the angle. Dorsal between the pectorals and ventrals higher than long, with a pungent spine and about 6 branched rays. Adipose fin short, inserted over the posterior half of the anal. Anal fin of varying length, with 15 to 35 rays, the usual number being 20 or 21. Caudal fin short, truncate in typical species, more or less forked in those species which approach the genus *Ictalurus.* Ventrals each with 1 simple and 7 branched rays. Pectoral fins each with a stout spine, which is commonly retrorse serrate behind. Lateral line usually incomplete. Species very numerous, swarming in every pond and sluggish stream in the Eastern United States; especially characteristic of quiet waters; 1 species *(A. cantonensis)* in China. The species are variable and not easily distinguished. Those in which the caudal fin is forked make an approach to the genus *Ictalurus.* The lack of connection between the supraoccipital and the interspinal buckler is the only character by which these species can be separated from *Ictalarus*, of which group *Ameiurus* should perhaps be regarded as a section. (ἀ, privative; *μείουρος*, curtailed; the caudal fin not notched.)

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[*] The Horned Pout are "dull and blundering fellows," fond of the mud and growing best in weedy ponds and rivers without current. They stay near the bottom, moving slowly about with their barbels widely spread, watching for anything eatable. They will take any kind of bait from an angle worm to a piece of tomato can, without hesitation or coquetry, and they seldom fail to swallow the hook. They are very tenacious of life, opening and shutting their mouths for half an hour after their heads have been taken off. They spawn in spring, and the old fishes lead the young in great schools near the shore, caring for them as a hen cares for her chickens. "A bloodthirsty and bullying set of rangers, with ever a lance at rest and ready to do battle with their nearest neighbor."—*Thoreau.*

HAUSTOR, (*haustor*, one who swallows):
*a.* Caudal fin lunate or forked; occipital process produced backward, not falling far short of the interspinal bones; species of large size, approaching *Ictalurus;* coloration more or less grayish or silvery.
*b.* Anal rays 25 to 35; humeral process very short and blunt, usually covered by skin, about ½ length of pectoral spine. LACUSTRIS, 209.
*bb.* Anal rays usually 20 to 22 (19 to 24).
*c.* Base of anal fin longer than head; head rather narrow, the bony occipital bridge almost complete. LUPUS, 210.
*cc.* Base of anal fin much shorter than head.
*d.* Humeral process strongly rugose; head and mouth narrow in young, becoming very broad in the adult. CATUS, 211.
*dd.* Humeral process slightly furrowed; head narrow. DUGESI, 212.
*bbb.* Anal very short, of about 16 rays, its base not ⅛ length of body and little more than ½ head; head broad, with long barbels. OKEECHOBEENSIS, 213.
AMEIURUS:
*aa.* Caudal fin entire, truncate or very slightly marginate behind. Eyes well developed. Coloration, brown or yellowish, not silvery.
*e.* Anal fin long, of 22 to 27 rays (counting rudiments), its base more than ¼ body.
*f.* Head and body elongate, the back high, the head much longer than broad; pectoral and dorsal spines very long. EREBENNUS, 214.
*ff.* Head and body robust, the back low, the head not much longer than broad, pectoral and dorsal spines moderate. NATALIS, 215.
*ee.* Anal fin moderate or short, of 15 to 22 rays, its base 4 to 5 in the body.
*g.* Lower jaw projecting; anal rays 20. VULGARIS, 216.
*gg.* Lower jaw not projecting.
*h.* Body rather robust, the depth in the adult 3½ to 4½ in length; head not very flat above.
*i.* Pectoral spines long, 2 to 2½ in head; anal rays more than 20. NEBULOSUS, 217.
*ii.* Pectoral spines short, 2½ to 3 in head, longest in young. Anal fin shorter, of 17 to 19 rays counting rudiments. MELAS, 218.
*hh.* Body slender and low, varying with age, the depth 5½ to 8 times in length; head in adult broad and very flat; anal short, usually with 18 or 19 rays; a broad dusky shade across the base of dorsal which is rather high. PLATYCEPHALUS, 219.
GRONIAS, (*γρώνη*, a cavern):
*aaa.* Caudal fin entire; eyes covered by thick skin.
*j.* Color chiefly black. NIGRILABRIS, 220.

### Subgenus HAUSTOR, Jordan & Evermann.

### 209. AMEIURUS LACUSTRIS, (Walbaum.)

(CATFISH OF THE LAKES; GREAT FORK-TAILED CAT; MISSISSIPPI CAT; FLORIDA CAT; FLANNEL MOUTH CAT; MATHEMEG, OR UGLY FISH.)

Head 4 in length; depth 5; distance to dorsal spine $2\frac{3}{4}$. D. I, 5; P. I, 9; A. 28 (25 to 32). Body rather stouter, head much broader, lower, and more depressed than in *Ictalurus punctatus*, its greatest width $\frac{5}{6}$ its length. Interorbital space somewhat more than $\frac{1}{2}$ the length of head. Width of the mouth about $\frac{1}{2}$ head. Eye moderate, wholly in front of middle point of head. Top of head covered with a thicker skin than in *punctatus*, so that the bones are nearly concealed. Upper surface of the head quite flattish; so that the eyes are much nearer the upper than the lower surface of the head. Barbels long, all black, the maxillary barbel reaching beyond head. Humeral process very short and blunt, covered by skin, a little more than $\frac{1}{3}$ the length of the pectoral spine. Caudal deeply forked, the upper lobe rather longer and narrower than the lower; dorsal a little nearer snout than adipose fin. Anal base as long as head. Olivaceous slaty, growing darker with age; sides pale, without dark spots; anal dusky edged. Saskatchewan River and Great Lakes to Florida and Texas; abundant in all large bodies of water, especially in the Mississippi and the Great Lakes. One of the largest of the catfishes, reaching a weight of 150 pounds or more. (*lacustris*, living in lakes.)

*Gadus lacustris*, WALBAUM, Artedi Pisc., 1792, 144, Arctic America, based on the Mathemeg, or Land Cod, of Pennant.
*Pimelodus nigricans*, LE SUEUR, Mém. Mus., v, 153, 1819, Lake Erie; Lake Ontario.
*Pimelodus nigrescens*, RICHARDSON, Fauna. Bor. Amer., III, 1836, 134, after Le Sueur.
*Pimelodus borealis*, RICHARDSON, *l. c.*, 135, 1836, Pine Island Lake.
*Amiurus borealis*, GÜNTHER, Cat., v, 100, 1864; JORDAN, *l. c.*, 84, 1877.
*Ictalurus lacustris*, JORDAN & GILBERT, Synopsis, 108, 1883.
*Amiurus ponderosus*, * BEAN, Proc. U. S. Nat. Mus., 1879, 286, St. Louis. (Type, 23388.)
*Ictalurus ponderosus*, JORDAN & GILBERT, Synopsis, 189, 1883.
*Ictalurus nigricans*, JORDAN & GILBERT, Synopsis, 882, 1883.

### 210. AMEIURUS LUPUS, (Girard).

Anal 23. Body rather slender. Head narrow, longer than broad, its width $4\frac{3}{4}$ in length, being less than its length above. Dorsal spine much nearer snout than adipose fin. Base of anal longer than head. Pectoral spines long and slender, dentate. Barbels long. Supraoccipital bone almost meeting the interspinal; the relations of the species therefore very close to *Ictalurus punctatus*. Dusky olivaceous, sides silvery. Rio Nueces and Rio Pecos, Texas; a rather doubtful species, apparently intermediate between *Ictalurus punctatus* and *Ameiurus catus*. (*lupus*, wolf.)

*Pimelodus lupus*, GIRARD, Pac. R. R. Expl., x. 211, 1858, Rio Pecos; JORDAN, *l.c.*, 83, 1877; GÜNTHER, Cat., v, 101, 1864.
*Ictalurus lupus*, JORDAN & GILBERT, Synopsis, 107, 1883.

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* *Amiurus ponderosus*, Bean, described from the Mississippi River at St. Louis from a specimen 5 feet long, weighing 150 pounds, is probably a giant example of this species, from which it differs only in the presence of 35 anal rays. In 4 specimens, which we refer to *A. lacustris*, we count 25, 27, 28, and 32 rays. We see no reason for doubting the identity of the "Land Cod," or Mathemeg of the Hudson Bay region, with *Ameiurus nigricans*. This northern species, called *borealis* by Richardson, is the original *lacustris* of Walbaum.

### 211. AMEIURUS CATUS,* (Linnæus).

(White Cat; Channel Cat of the Potomac.)

Body stout, slender in the young, the head becoming excessively broad in the adult. Barbels long, except nasal barbel; caudal fin deeply forked, the upper lobe the longer. Humeral process more than ½ the length of the spine, extremely rugose. Anal rays 21 (19 to 22); base of anal 4½ to 5 in length. Dorsal fin inserted nearly midway between adipose fin and snout. Pale olive bluish, silvery below without dark spots, but sometimes mottled or clouded. L. 2 feet. Delaware River to Texas, very common in the coastwise streams and swamps, especially about Chesapeake Bay and in Florida; also lately introduced into the Sacramento and San Joaquin rivers, where it is becoming abundant. (Low Latin, *catus*, cat.)

*Silurus catus*, Linnæus, x, 305, 1758; based on the Catfish of Catesby, (*Bagre secundæ speciei marcgravei affinis*), which is a rude figure of the adult, or "*lophius*," form of this species; Northern part of America.

*Pimelodus albidus*, Le Sueur, Mém. Mus., v, 148, 1819, Delaware River.

*Pimelodus lynx*, Girard, Proc. Ac. Nat. Sci. Phila., 1859, 160, Potomac River.

*Amiurus albidus*, Jordan, *l. c.*, 84, 1877.

*Ictalurus albidus*, Jordan & Gilbert, Synopsis, 107, 1883.

*Amiurus niveiventris*, Cope, Proc. Am. Phil. Soc., 1870, 486, Neuse River; Jordan, *l. c.*, 83, 1877.

*Ictalurus niveiventris*, Jordan & Gilbert, Synopsis, 107, 1883.

*Amiurus lophius*, Cope, Proc. Am. Phil. Soc., 1870, 486, Potomac River; Jordan, *l. c.*, 85, 1877.

*Ictalurus lophius*, Jordan & Gilbert, Synopsis, 107, 1883.

*Ictalurus macaskeyi* and *I. kevinskii*, Stauffer, History Lancaster County, Pa., 578, 1869, Lancaster County, Pa.

### 212. AMEIURUS DUGESI, Bean.

Allied to *A. catus*, but with narrower head, its width 5 in length; humeral process slightly furrowed, not strongly rugose as in *A. catus;* caudal deeply forked. Color plumbeous, silvery below. D. I, 6; A. 21. Rio Turbio, Guanajuato, Mexico, west of the Sierra Madre. (To Alfredo Dugès, a naturalist and teacher in Guanajuato.)

*Ameiurus dugèsi*, Bean, Proc. U. S. Nat. Mus., 1879, 304, Rio Turbio, Guanajuato. (Type, No. 23122 and 23123.)

### 213. AMEIURUS OKEECHOBEENSIS, (Heilprin).

This species is known only from a figure,† no description having been published. This figure shows the form of *Ameiurus catus*, the caudal deeply forked, barbels long and slender, the fins low, the anal very short, apparently of 15 or 16 rays and much shorter than head, the spines small, the occipital bridge apparently complete as in *Ictalurus* (to which genus it may belong), and the color entirely black, as is the case with nearly all fishes in black-water swamps. The type is from Kissimee River, near Lake Okeechobee, in the everglades of Florida.

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* We indentify the *Silurus catus* of Linnæus, or rather the figure of Catesby on which it is based with *Amiurus albidus* of Le Sueur, the adult of which species well answers to Catesby's account, and fairly matches his rough figure. Catesby's fish was from the "Northern part of America," and had a mouth so large that the fish could swallow another of its own size, ("ejusque amplitudinis rictus, et piscem æqualis magnitudinis capere possit." It reaches a length of 2 feet. The adult form (called "*lophius*") of the present species abounds in the Potomac, and has a larger mouth than any other of the tribe. Southern specimens called *niveiventris* by Cope, from the Neuse to St. Johns, are rather slenderer in from, but we know of no character by which the two can be positively separated. If a difference exists, the southern form may stand as *Ameiurus niveiventris*, the northern as *A. catus*.

† The figure of Heilprin has much in common with that of Catesby, which is the basis of the name *Ameiurus catus*.

*Ictalurus okeechobeensis*, HEILPRIN, Trans. Wagner Inst. Sci. Phila., I, 1887, pl. 18, Kissimee River, Florida.

### Subgenus AMEIURUS.

### 214. AMEIURUS EREBENNUS, Jordan.

Body rather elongate, compressed, the depth about 4⅓ in length. Dorsal region rather elevated; the head quite long and narrowed forward, 4 times in length of body. Head more narrowed than in *A. natalis;* width of head in front of eye little more than ½ its length; width of the mouth about ½ length of head. Greatest width of head contained 1⅓ times in its length. Dorsal fin slightly nearer the snout than the adipose fin, unusually high, its spine long. Pectoral spines strong, about ½ as long as the head. Anal fin long, deep, nearly ⅓ the length of the body, of 22 to 24 rays. Adipose fin large; caudal fin rather short, truncate behind. Jaws subequal. Supraoccipital process but little free behind. Color black; belly paler; fins and barbels black. Coast swamps and black-water streams from New Jersey to Florida. Close to *A. natalis*, but with narrower head and longer spines. (*ἐρεβεννός*, color of Erebus, which is very black.)

*Ameiurus erebennus*, JORDAN, Bull. U. S. Nat. Mus., x, 85, 1877, St. Johns River, Florida; JORDAN & GILBERT, Synopsis, 105, 1883.

*Amiurus prosthistius*,* COPE, Proc. Ac. Nat. Sci. Phila., 1883, 133, Batstoe River, N. J.

### 215. AMEIURUS NATALIS, (Le Sueur).

(YELLOW CAT.)

Anal rays 24 to 27. Body more or less short and chubby, sometimes extremely obese (var. *natalis*), sometimes more elongate (var. *lividus*). Head short and broad; mouth wide, the jaws equal (var. *lividus*), or the upper jaw longest (var. *cupreus*). Yellowish, greenish, or blackish. Great Lake region to Virginia and Texas, and southward; generally abundant, extremely variable, and running into several varieties.† (*natalis*, having large nates, or buttocks.)

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* Except that the caudal fin is said to be rounded rather than truncate, *A. prosthistius* agrees with *A. erebennus*, with which we think it will prove identical. Greatest width of head equal to depth of body; eye small, 5 in interorbital width; dorsal spine inserted much nearer tip of snout than adipose fin; pectoral spines a little larger than dorsal spine; maxillary barbel reaching middle of pectoral spine; humeral process extending a little farther; black, whitish below; fins black; pectoral and ventral pale at base; head 3⅔; depth 4¼. D. I, 6; A. 24 to 27. Batstoe River, New Jersey.—*Cope.*

† These varieties have been thus diagnosed:

*a.* Dorsal considerably nearer snout than adipose fin.
  *b.* Jaws equal; spines very short; anal rays 25; colors yellowish brown. Ohio River to Arkansas, North Carolina, and south. LIVIDUS.
  *bb.* Jaws unequal, the upper the longer.
    *c.* Anal rays 24 or 25, the fin rather low, its base 3¼ in body, nape not swollen.
      *d.* Colors pale, yellowish brown. Mississippi valley and south. CUPREUS.

*Pimelodus natalis*, Le Sueur, Mém. Mus., v., 154, 1819, **North America.**

*Amiurus natalis*, Günther, v, 101, 1864; Jordan, *l. c.*, 86, 1877.

*Silurus lividus*, var. *fuscatus*, and *Silurus cupreus*, Rafinesque, Quart. Jour. Sci. London, 1820, 48, 51, **Ohio River.**

*Pimelodus felinus et antoniensis*, Girard, Pac. R. R. Expl., x. 209, 1858, **Canadian and San Antonio rivers, Texas.** (Type, Nos. 924 and 923.)

*Pimelodus catus*, Girard, Proc. Ac. Nat. Sci. Phila., 1859, 159, **Aux Plaines, Illinois.**

*Pimelodus cupreoides*, Girard, *l. c.*, 1859, 159, **Aux Plaines, Illinois.** (Type, No. 1497.)

*Pimelodus cœnosus*, Richardson, Fauna Bor. Amer., iii, 132, 1836, **Lake Huron.**

*Pimelodus cupreus*, Rafinesque, Ichth. Oh., 65, 1820, **Ohio River.**

*Amiurus natalis*, Jordan & Gilbert, Synopsis, 105, 1883.

*Amiurus bolli*, Cope, Bull. U. S. Nat. Mus., xx, 35, 1880, **Little Wichita River, Texas.**

*Ameiurus bolli*, Jordan & Gilbert, Synopsis, 881, 1883; this form has rather longer spines than usual in *natalis*, approaching *erebennus*.

*Amiurus natalis analis*, Jordan, *l. c.*, 1877, 81, **Arkansas River.** (Type, No. 31088.)

### 216. AMEIURUS VULGARIS, (Thompson).

Anal rays 20. Body moderately elongate; depth 4½ to 5 in length; head 3½ to 4. Barbels long; mouth wide; head longer than broad, rather narrowed forward; profile rather steep, evenly convex; dorsal region more or less elevated. Lower jaw more or less distinctly projecting; in other respects scarcely distinct from *A. nebulosus*, with which it may intergrade. Dark reddish brown or blackish. L. 18 inches. Vermont to Minnesota and Illinois, chiefly northward; not rare. (*vulgaris*, common, which is not true in most of its range.)

*Pimelodus vulgaris*, Thompson, Hist. Vermont, 138, 1842, **Lake Champlain.**

*Pimelodus dekayi*, Girard, Proc. Ac. Nat. Sci. Phila., 1859, 160, **Oswego, N. Y.** (Type, No. 1513.)

*Pimelodus ailurus*, Girard, Pac. R. R. Expl., x, 210, 1858, **L. Amelia, Minnesota.** (Type, No. 904.)

*Amiurus ælurus*, Jordan, *l. c.*, 1877, 88.

*Amiurus vulgaris*, Jordan & Gilbert, Synopsis, 105, 1883.

### 217. AMEIURUS NEBULOSUS, (Le Sueur).

(Horned Pout; Common Bullhead; Small Catfish; Schuylkill Cat; Sacramento Cat.)

Body rather elongate; depth 4 to 4½ in length. Anal fin usually with 21 or 22 rays, its base 4 in body; dorsal fin inserted rather nearer adipose fin than end of snout. Upper jaw usually distinctly longer than lower. Humeral process more than ½ the length of pectoral spine, which is rather long. Color dark yellowish brown, more or less clouded, sometimes yellowish, sometimes nearly black. L. 18 inches. Great Lakes, Ohio Valley, eastward to Maine, southwestward to Texas, and southeastward to Florida. The common bullhead, or Horned Pout of the North and East, abundant in every pond and stream; also introduced about 1877 into the Humboldt, Sacramento, San Joaquin and Gila rivers, where it is now excessively abundant. Variable. (*nebulosus*, clouded.)

*Pimelodus nebulosus*, Le Sueur, Mém. Mus., v. 149, 1819, **Lake Ontario.**

*Pimelodus atrarius*, De Kay, N. Y. Fauna: Fish., 185, 1842, **Wappingers Creek, Dutchess County, N. Y.**

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*dd.* Colors dark, black or greenish. Great Lake region, north and east. CŒNOSUS.

*cc.* Anal 26; rays low, its base 3½ in body; spines weak; nape more or less swollen and elevated. Alabama River to Texas. ANTONIENSIS.

*ccc.* Anal 27, its base 3⅓ in length, its rays high, more than ½ head; spines strong, nape not swollen. Little Red River, Ark. ANALIS.

*aa.* Dorsal spine inserted nearer adipose fin than tip of snout, the posterior part of body thickened and shortened; jaws subequal. Great Lakes to North Carolina and south. NATALIS.

*Amiurus catus*, Jordan & Gilbert, Synopsis, 104, 1883.
*Pimelodus felis*, Agassiz, Lake Superior, 281, 1850, Lake Superior.
*Pimelodus vulpeculus*, Girard, Proc. Ac. Nat. Sci. Phila., 1859, 160, Charleston. (Type, No. 1530.)
*Pimelodus hoyi*, Girard, *l. c.*, 159, 1859, Racine, Wisconsin. (Type, No. 1539.)
*Ameiurus mispilliensis*, Cope, Proc. Am. Phil. Soc., 1870, 486, Mispillion Creek, Delaware.

Of the variations of this species, the following seem worthy of recognition as subspecies:

### 217a. AMEIURUS NEBULOSUS CATULUS, (Girard).

Color nearly black; profile very steep. Abundant in the streams of Texas. (Diminutive of *catus*, cat.)

*Pimelodus catulus*, Girard, Pac. R. R. Survey, 208, 1858, Fort Smith, Arkansas.

### 217b. AMEIURUS NEBULOSUS MARMORATUS, (Holbrook).

Body sharply mottled with brown, greenish, and whitish; jaws equal, or nearly so; depth about 4 in length; slope of profile very steep. Dorsal fin high; the spine more than ½ length of head; dorsal spine nearer adipose fin than snout. Barbels long. Head 3¼ in length. Anal 21. Lowland streams and swamps from southwestern Indiana (Switz City) southward and eastward to Florida; the color strongly marked, but this intergrades with mottled specimens of *A. nebulosus*. (*marmoratus*, marbled.)

*Pimelodus marmoratus*, Holbrook, Jour. Ac. Nat. Sci. Phila., 1855, 54, South Carolina. (Type, No. 9031.)
*Ameiurus marmoratus*, Jordan & Gilbert, Synopsis, 104, 1883.

### 218. AMEIURUS MELAS, (Rafinesque).

(Black Bullhead; Small Catfish.)

Color almost black, varying to yellowish and brown. Body stout, short and deep, the depth 3½ to 4½ in length. Head broad behind, rather contracted forward, the front steeply elevated. Pectoral spines short, 2½ to 3 in head. Anal fin short and deep, of 17 to 19 rays, its base nearly 5 in length, the color of the rays forming a sharp contrast with that of the dusky membranes. Jaws nearly equal. Barbels longer than head. Humeral process rather long, rugose. Size small. Northern New York (Genesee River) to Kansas and Texas. Common, especially west of the Mississippi. Variable. Much resembles *A. nebulosus*, but smaller, with shorter, deeper anal, and especially shorter pectoral spines. (μέλας, black.)

*Silurus melas*, Rafinesque, Quart. Jour. Sci. Lit. Arts Lond., 1820, 51, Ohio River.
*Pimelodus confinis*, Girard, Proc. Ac. Nat. Sci. Phila., 1859, 159, Racine, Wis. (Type, No. 1514.)
*Amiurus obesus*, Gill, Proc. Bost. Soc. Nat. Hist., 1862, 45, Nebraska. (Type, No. 8968.) Jordan, *l. c.*, 89, 1877.
*Pimelodus pullus*, De Kay, N. Y. Fauna: Fishes, 184, 1842, Lake Pleasant, Lake Janet, N. Y.
*Amiurus pullus*, Jordan, *l. c.*, 93, 1883.
*Amiurus cragini*, Gilbert, Bull. Washb. Lab. Nat. Hist., 1884, I, 10, Garden City, Kansas. (Type, No. 36814.)
*Amiurus brachyacanthus*, Cope, Bull. U. S. Nat. Mus., XX, 35, 1880, Medina River, Texas.
*Ameiurus brachyacanthus*, Jordan & Gilbert, Synopsis, 881, 1883.
*Silurus xanthocephalus*, Rafinesque, Quart. Jour. Sci. Lit. Arts Lond., 1820, 51, Ohio River; Jordan, *l. c.*, 42, 1877.
*Ameiurus xanthocephalus*, Jordan & Gilbert, Synopsis, 104, 1883.

### 219. AMEIURUS PLATYCEPHALUS, (Girard).

(MUD CAT; BROWN CAT.)

Body extremely elongate; mesially, nearly terete. Head low, flat, and broad; upper jaw strongly projecting, the head much broader and more depressed in old specimens. Dorsal fin high, ⅔ length of head, its spines nearer snout than adipose fin; depth 5½ to 8 in length. Head 3½; its width 3 to 5, base of anal 6; anal rays 16 to 20. Caudal slightly emarginate. Young specimens much less elongate than adults. Clear olive brown, varying into yellowish or greenish; a blackish horizontal bar or shade at base of dorsal. L. 18 inches; slenderest of the species of the genus, and almost entirely herbivorous, its elongate intestine being always filled with water plants. A good food fish. The form called *brunneus* is the young, differing from the adult much as the young of *A. catus* differs. Abundant in the streams of Carolina and eastern Georgia, Cape Fear to the Chattahoochee. (*πλατύς*, wide; *κεφαλή*, head.)

*Pimelodus platycephalus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 161, **Anderson, S. C.** (Type, No. 1534.)

*Amiurus brunneus*, JORDAN, Ann. Lyc. Nat. Hist. N. Y., 1877, 366, **Ocmulgee River, Flat Shoals, Georgia.** (Type, No. 20148.)

*Ameiurus brunneus*, JORDAN, *l. c.*, 93, 1877.

*Amiurus brunneus*, JORDAN & BRAYTON, Bull. U. S. Nat. Mus., XII, 28, 1878.

*Amiurus brunneus* and *platycephalus*, JORDAN & GILBERT, Synopsis, 103, 1883.

### Subgenus GRONIAS, Cope.

### 220. AMEIURUS NIGRILABRIS, (Cope).

Black above; jaws and fins black; sides varied with yellowish; belly pale. Eyes more or less rudimentary and concealed beneath the skin. Jaws equal. Dorsal spine midway between snout and middle of adipose fin; barbels short; caudal slightly emarginate. Anal with 18 rays. Branchiostegals 10. Cave streams tributary to Conestoga River in eastern Pennsylvania. Very close to *Ameiurus melas*, from which, or some similar species, it is doubtless recently descended. (*niger*, black; *labrum*, lip).

*Gronias nigrilabris*, COPE, Proc. Ac. Nat. Sci. Phila., 1864, 231, **Conestoga River.**

*Amiurus nigrilabris*, JORDAN, *l. c.*, 92, 1877.

*Gronias nigrilabris*, JORDAN & GILBERT, Synopsis, 102, 1883.

## 78. LEPTOPS, Rafinesque.

(MUD CATS.)

*Leptops*, RAFINESQUE, Ich. Oh., 64, 1820, (*viscosus* = *olivaris*).

*Opladelus*, RAFINESQUE, *l. c.*, 64, (*nebulosus*).

*Ilictis*, RAFINESQUE, *l. c.*, 66, (*limosus*).

*Hopladelus*, GILL, (corrected spelling).

*Pelodichthys*, JORDAN, corrected spelling of *Pilodictis*,* RAFINESQUE, which is an imaginary fish.

Body elongated, slender, much depressed anteriorly. Head large, very wide and depressed. Skin very thick, entirely concealing the skull; supraoccipital bone entirely free from the head of the second interspinal;

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* "*Pilodictis limosus*," Rafinesque, Jour. Phys., Paris, 1819, 422, was based on a "drawing by Mr. Audubon," which drawing, as shown by Rafinesque's copy, is merely a fancy sketch of an imaginary catfish. The name should therefore be disregarded, although it is the earliest supposed to belong to this group. Of the remaining synonyms *Leptops* stands next in date.

eyes small. Mouth very large, anterior and transverse, the lower jaw always projecting beyond the upper. Teeth in broad villiform bands on the premaxillaries and dentaries; band of upper jaw convex anteriorly, and at insertion of the maxillaries, abruptly angularly deflected, proceeding backward as an elongated triangular extension. Band slightly divided at the symphysis; lower band of teeth anteriorly semicircular and attenuated to the corners of the mouth. Branchiostegals 12. Dorsal fin over the posterior half of the interval between pectorals and ventrals, with a spine and 7 rays; spine rather small, more or less enveloped in thick skin. Adipose fin large, its elongated base over posterior ½ of anal. Anal fin small, commencing far behind the anus; of about 13 rays. Caudal oblong, subtruncate, with numerous accessory rays, recurrent above and behind. Pectorals with a broad compressed spine, serrated on both margins and with a prolonged fleshy integument, obliquely striated. One species known; a large catfish living in the muddy bottoms of deep rivers. (*λεπτός*, slender; *ὤψ*, face, the head being slender in profile.)

### 221. LEPTOPS OLIVARIS, (Rafinesque).

(Mud Cat; Yellow Cat; Bashaw; Russian Cat.)

Body slender, depressed forward, the head extremely flat, the lower jaw the longer. Barbels short. Dorsal spine very weak, ½ the height of the fin; caudal very slightly emarginate behind. Anal short, its base about ⅙ the length, its rays 12 to 15. Humeral process short. Yellowish, much mottled with brown and greenish, whitish below. Size very large, reaching a weight of 50 to 75 pounds. Rivers of the Mississippi Valley and Southern States, southwest to Chihuahua; abundant in deep, sluggish waters. A fish of unprepossessing appearance, although one of the best of the family as food. (*olivaris*, olive-colored.)

*Silurus olivaris*, Rafinesque, Amer. Month. Mag., 1818, 355, Ohio River.
*Hopladelus olivaris*, Gill, Ichth. Simpson's Expl., 426, 1876.
*Pelodichthys olivaris*, Jordan, *l. c.*, 95, 1877.
*Silurus nebulosus*, *viscosus*, and *limosus*, Rafinesque, Quart. Jour. Sci. Lit. Arts Lond., 1820, 50, Ohio River.
*Pimelodus punctulatus*, Günther, Cat., v, 101, 1864.
*Pylodictis limosus*, Rafinesque, Ichth. Oh., 67, 1820, based on a drawing by Audubon; Ohio and Mississippi rivers.
*Pimelodus punctulatus*, Cuvier & Valenciennes, xv, 134, 1840, New Harmony, Indiana.
*Pimelodus æneus*, Cuvier & Valenciennes, xv, 135, 1840, New Orleans.
*Pilodictis olivaris*, Jordan & Gilbert, Synopsis, 102, 1883.
*Leptops olivaris*, Jordan & Gilbert, Synopsis, 881, 1883.

## 79. NOTURUS, Rafinesque.

(Stone Cats.)

*Noturus*, Rafinesque, Amer. Month. Mag., November, 1818, 41, (*flavus*).

This genus contains a single species, similar to the species of *Schilbeodes* in appearance and habit, but having the dentition of *Leptops*, the band of teeth in the upper jaw having a backward prolongation from the outer posterior angle. The adipose fin is adnate to the back as in *Schilbeodes*, and there is a poison gland at the base of the pectoral fin. The species reaches a larger size than those of *Schilbeodes*, and it frequents rivers and channels rather than small brooks. (*νῶτος*, back; *οὐρά*, tail, in allusion to the connection of the caudal with the adipose fin; "means tail over the back." Rafinesque.)

### 222. NOTURUS FLAVUS, Rafinesque.

(STONE CAT.)

Body elongate; the head depressed, broad, and flat, nearly as broad as long; middle of body subcylindrical; tail compressed. Head about 4¼ in length; width of head 5⅓; depth 5⅝ in length; distance to dorsal about 3 in length. Barbels short. A strong keel on back behind dorsal, leading to adipose fin; adipose fin deeply notched. Dorsal spine very short; pectoral spine retrorsely serrate in front, slightly rough or nearly entire behind; its length 3 in distance from snout to dorsal; caudal rounded behind. Anal rays about 16. Humeral process very short and sharp. Color nearly uniform yellowish brown, sometimes blackish above, fins yellow-edged. The largest species of stone cat, reaching a length of more than a foot. Great Lake region, westward and south to Montana, Wyoming, and Texas; rather common, especially westward. (*flavus*, yellow.)

*Noturus flavus*, RAFINESQUE, Amer. Month. Mag., 1818, 41, Falls of Ohio River.

*Noturus luteus*, RAFINESQUE, Jour. de Phys., 1819, 421, Ohio River; GÜNTHER, Cat., v, 104, 1864; JORDAN, *l. c.*, 99, 1877.

*Noturus occidentalis*, GILL, Proc. Bost. Soc. Nat. Hist., 1862, 45, Platte River; GÜNTHER, Cat., v, 105, 1864.

*Noturus platycephalus*, GÜNTHER, Cat., v, 104, 1864, North America.

*Noturus flavus*, JORDAN & GILBERT, Synopsis, 100, 1883.

## 80. SCHILBEODES, Bleeker.

(MAD TOMS.)

*Schilbeodes*, BLEEKER, Ichth. Archip. Indici. Prodr. Siluri., 1858, 258, (*gyrinus*).

*Rabida*, JORDAN & EVERMANN, new subgenus, (*furiosus*).

Body more or less elongate, anteriorly subcylindrical, thence more or less compressed. Head depressed. Skin very thick, entirely concealing the bones. Supraoccipital entirely free from the head of the second interspinal. Mouth anterior, rather large; the upper jaw more or less projecting. Teeth subulate, in a broad band, in each jaw; the band in the upper jaw is abruptly truncated at each end as in *Ameiurus* (not prolonged backward by a continuation from the external angle, as in *Leptops* and *Noturus*). Branchiostegals 9. Dorsal fin over the posterior half of the interval between pectorals and ventrals, with a short sharp spine and 7 rays. Adipose fin long and low, usually more or less connected with the accessory rays of the caudal fin, not free posteriorly, but adnate to the body; the membrane sometimes high and continuous, sometimes notched. Caudal fin very obliquely truncated or rounded, inserted on an equally obliquely rounded base; numerous rudimentary rays present, both above and below the caudal peduncle. Anal fin short, with 12 to 23 rays. Ventrals rounded. Pectoral fins with a sharp spine, of different forms in the different species. Vent at some distance in advance of the anal. Lateral line complete. In or above the axil of the pectoral fins is an orifice, which is the opening of the duct of a poison gland. "From it may frequently be drawn a solid gelatinous style ending in a tripod, each limb of which is dichotomously divided into short branches of regular length."—*Cope.* The sting from the pectoral spine is very painful, resembling the sting of a bee, but worse. Very small catfishes of the fresh waters of the Eastern United States, having somewhat the habits of *Etheostoma*, or *Cottus*, lying on the bottom among rocks and weeds, and delighting in small rocky brooks. They are especially numerous southward. (*Schilbe*, an African genus of *Siluroids*, with which these fishes were supposed to agree in lacking an adipose fin; *εἶδος*, likeness. The word *Schilbe* is of Arabian origin.)

SCHILBEODES:

*a.* Pectoral spine entire or grooved behind, never retrorse serrate; adipose fin high and continuous, not separated by a notch from caudal; caudal much rounded.

*b.* Head short, broad and deep; pectoral spine without serration anywhere, grooved behind, 2 in head; barbels short; plain dark brown, with a narrow black lateral streak. A. 15 or 16. GYRINUS, 223.

*bb.* Head small and narrow; spines very short and weak; pectoral spine weakly retrorse serrate without, grooved within, 3½ in head. A. 14. Color yellowish, slightly mottled. LEPTACANTHUS, 224.

RABIDA, (*rabidus, mad*):

*aa.* Pectoral spine more or less distinctly serrate behind (the serræ sometimes absent in *S. nocturnus*).

*c.* Adipose fin continuous with the caudal, there being no evident notch between them; pectoral spine short, 2 in head, its inner margin usually with a few short, sharp teeth on basal half, its outer nearly entire, a few points near the tip. A. 15 or 16. Color plain blackish. NOCTURNUS, 225.

*cc.* Adipose fin with a more or less distinct notch separating it from the caudal.

*d.* Anal fin comparatively long, of 23 rays; body elongate; adipose fin conspicuously notched; spines slender and short, pectoral spines with weak teeth on each margin. Color plain blackish. FUNEBRIS, 226.

*dd.* Anal fin rather short, of 12 to 18 rays.

*e.* Pectoral spine with its posterior serræ short, their length not ½ diameter of spine. Color nearly plain.

*f.* Adipose fin moderate, the notch shallow, not separating it from the caudal fin; caudal slightly rounded; vertical fins broadly edged with black.

*g.* Pectoral spine very short and weak, about 3 in head in adult; head small, 4 in length. EXILIS, 227.

*gg.* Pectoral spine moderate, about 2 (1¾ to 2¼) in head; head larger. INSIGNIS, 228.

*ff.* Adipose fin very low, the notch completely separating it from caudal; pectoral spine very short, 4 to 5 in head, its outer margin nearly entire, the inner with sharp teeth at base; caudal slightly emarginate; base of dorsal and lower lobe of caudal black. GÍLBERTI, 229.

*ee.* Pectoral spine with its posterior serræ strong, spine-like, recurved, almost as long as the diameter of the spine, the long curved spine itself more than ½ head; anal rays 13 to 15; caudal much rounded.

*h.* Adipose fin nearly or quite free from caudal; color nearly plain brownish, the saddle-like blotches faint; everywhere covered with small dots; anterior edge of pectoral spine retrorse-serrate. ELEUTHERUS, 230.

*hh.* Adipose fin not quite free from caudal; color much variegated, the back with black saddle-like blotches; fins marbled with black.

*i.* Pectoral spine strong, about 1⅔ in head, its anterior edge with few serrations. MIURUS, 231.

*ii.* Pectoral spine very strong, about 1¼ in head, its anterior edge with many serrations. FURIOSUS, 232.

### Subgenus SCHILBEODES.

### 223. SCHILBEODES GYRINUS, (Mitchill).

Body comparatively short and thick. Head large, its width 3½ to 4½ in length of body; depth 4 to 5½; head 3½ to 4. Spines stout and rather long; that of the pectoral fin straight, not serrated, grooved behind, 2⅓ in the distance from snout to dorsal fin. Dorsal higher than long, inserted nearer anal than snout. Anal 13. Jaws nearly equal. Humeral process short. Nearly uniform yellowish brown, sometimes blackish, without transverse blotches; a narrow dark lateral streak and 1 or more dorsal ones. L. 5 inches. Hudson River and westward through almost the entire Mississippi Valley, and upper lake region; rather common, especially northwestward; the western specimens more robust and perhaps distinguishable as var. *sialis*. (*γυρινός*, tadpole.)

*Silurus gyrinus*, MITCHILL, Amer. Month. Mag., 1818, 322, Walkill River, New York.
*Noturus gyrinus*, JORDAN, Bull. U. S. Nat. Mus., x, 102, 1877.
*Noturus sialis*, JORDAN, Bull. U. S. Nat. Mus., x, 102, 1877, White River, Indiana.
*Noturus gyrinus*, JORDAN & GILBERT, Synopsis, 98, 1883.

### 224. SCHILBEODES LEPTACANTHUS, (Jordan).

Body slender, the head small and narrow, longer than broad. Eye small. Upper jaw much projecting. Spines very short and slender; that of the dorsal not ⅓ the height of the fin; all less than ⅓ the length of the head; that of the pectoral retrorsely serrate on the outer edge, entire within. Head 4⅘ in body; its width 5½; depth 5½; distance to dorsal 2⅘; pectoral spine 5 in this distance; dorsal nearer anal than snout. Anal 14. Humeral process very short. Color yellowish, somewhat mottled. L. 3 inches. Gulf States in sandy streams; scarce, known from the basins of the Ogeeche, Alabama, and Pearl rivers. (*λεπτός*, slender; *ἄκανθα*, spine.)

*Noturus leptacanthus*, JORDAN, Ann. Lyc. Nat. Hist. N. Y., 1876, 352, Silver Creek, branch of Etowah River, Rome, Ga.
*Noturus leptacanthus*, JORDAN, *l. c.*, 102, 1877.
*Noturus leptacanthus*, JORDAN & GILBERT, Synopsis, 98, 1883.

### Subgenus RABIDA, Jordan & Evermann.

### 225. SCHILBEODES NOCTURNUS, (Jordan & Gilbert).

Head 3⅔. A. 15 or 16. Rather robust; head moderate, little depressed, eyes small; barbels short, barely reaching gill opening; pectoral spine short, 2 in head, its inner margin with short, sharp teeth at base (entire in specimens from the lower Wabash); its outer margin with a few points near tip, otherwise entire; adipose fin high, continuous with caudal; anal high. Color very dark brown, everywhere dotted with black; fins dusky with narrow pale margins. L. 3 inches. Sandy streams, among weeds, in Lower Mississippi Valley, known from the lower Wabash in Indiana, and from the Poteau, Washita, and Saline rivers, Arkansas. (*nocturnus*, nocturnal, from its black color.)

*Noturus nocturnus*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1886, 6, Saline River, at Benton, Arkansas. (Type, 36461.)

### 226. SCHILBEODES FUNEBRIS, (Gilbert & Swain).

Head 4. A. 23, its base 3½ in body. Body elongate, the head slender but not depressed; mouth moderate, very convex, the lower jaw shorter; barbels slender, those of maxillary reaching beyond base of pectoral; eye very small. Spines slender and short; pectoral spine 3 in head, roughened without, and with 3 or 4 small weak teeth on inner margin. Adipose fin well developed, with a conspicuous notch. Anal much longer than in other species. L. 3½ inches. Body and fins uniform black. Tributary of Black Warrior River, Tuscaloosa, Ala. (*funebris*, funereal, from the dark color.)

*Noturus funebris*, Gilbert & Swain, Bull. U. S. Fish. Com., 1889, 153, North River, Tuscaloosa, Alabama. (Type, No. 36696.)

### 227. SCHILBEODES EXILIS, (Nelson).

Head 4 in length; depth 5 to 6½. Anal rays 14 to 17. Pectoral spine small, about 3 in head, slightly retrorse serrate without, with about 6 small straight teeth within, which are not ½ the diameter of the spine in length. Head small, not very broad, but thin and depressed; its width 5 to 6 in length of body; jaws nearly equal. Dorsal scarcely higher than long. Distance from snout to dorsal about 3 in length. Pectoral spine 3½ to 4 in this distance; dorsal spine low, as near snout as anal. Humeral process obscure. Color yellowish brown, mottled, the fins somewhat margined with dusky. L. 4 inches. Wisconsin to Missouri and Kansas, common in prairie streams; close to *S. insignis*, but slimmer, with weaker armature. (*exilis*, slim.)

*Noturus exilis*, Nelson, Bull. Ill. Mus. Nat. Hist., 1876, 51, Illinois River; Jordan, *l. c.*, 100, 1877; Jordan & Gilbert, Synopsis, 100, 1883.

*Noturus elassochir*, Swain & Kalb, Proc. U. S. Nat. Mus., 1882, 639, Illinois River, Napierville, Illinois. (Type, No. 29677.)

### 228. SCHILBEODES INSIGNIS, (Richardson).

(Mad Tom.)

Body rather elongate. Pectoral spine moderate, about 2 in head, retrorse serrate without, weakly serrate within. Head broad and flat, upper jaw projecting; head about 4¼ in length; depth 6. Dorsal fin ¼ higher than long. Distance from snout to dorsal about 2⅘ in length. Length of pectoral spine 2⅖ in same distance. Dorsal much nearer anal than snout. Anal rays 14 to 16. Humeral process conspicuous, sharp. Color dark brown, somewhat mottled, fins all broadly and conspicuously dark-edged. One of the largest species, reaching the length of nearly a foot. Pennsylvania to South Carolina; very common in streams east of the Alleghanies. (*insignis*, remarkable.)

*Pimelodus insigne*, Richardson, Fauna Bor. Amer., III, 32, 1836, based on *Pimelode livrée*, Le Sueur, Mém. Mus., v, 1819, 155; locality not known.

*Pimelodus lemniscatus*, Cuvier & Valenciennes, xv, 144, 1840, after Le Sueur.

*Noturus marginatus*, (Baird), Cope, Jour. Ac. Nat. Sci. Phila., 1869, 237, Pennsylvania. (Type, No. 1571.)

*Noturus insignis*, Jordan, *l. c.*, 100, 1877; Jordan & Gilbert, Synopsis, 100, 1883.

### 229. SCHILBEODES GILBERTI, (Jordan & Evermann).

Body slender, less compressed than in *S. insignis*, the head narrower and not so low; eyes small; lower jaw included; barbels short, not reaching nearly to gill opening; spine very short, that of pectoral about 4 in head, its inner margin with sharp teeth at base, its outer nearly entire. Adipose fin very low, separated from the caudal by a deep notch which reaches its base. Anal short and high; dorsal spine scarcely longer than eye; caudal broad, slightly emarginate. Dark yellowish brown, base of caudal and most of its lower lobe black; dorsal black at base. Head 4$\frac{4}{5}$. A. 15. L. 4 inches. Roanoke River in Southern Virginia, locally abundant. (Named for Charles Henry Gilbert.)

*Noturus gilberti*, Jordan & Evermann, Proc. U. S. Nat. Mus., 1888, 352, Roanoke River. (Type, No. 39931.)

### 230. SCHILBEODES ELEUTHERUS, (Jordan).

Head 3$\frac{4}{5}$. A. 13. Head broad, flat, depressed, the form resembling that of *Leptops olivaris;* humeral process obscure; eye 5$\frac{1}{2}$ in head; lower jaw included; barbels short, not reaching gill opening; adipose fin free from caudal; pectoral spine stout, of moderate length, 1$\frac{2}{3}$ to 2 in head, its outer margin more or less retrorse-serrate, its inner with about 6 to 8 retrorse hooks, scarcely weaker than in *S. miurus*. Color nearly plain brownish, the black saddle-like blotches usually not very distinct; body everywhere covered with fine dark dots. Dorsal blackish at tip; caudal dark at base. L. 4 inches. Mississippi Valley, rare, but widely distributed. Tributaries of French Broad River (Big Pigeon River, Clifton, Tenn.); French Broad, at Hot Springs, N. C.; White River, Gosport, Ind.; Green River, Greensburg, Ky. Schriner Lake, Columbia City, Ind.; White River, Fayettesville, Ark.; Sallisaw River, Indian Territory. Only a few specimens known. (*ἐλεύϑερος*, free.)

*Noturus eleutherus*, Jordan, Ann. N. Y. Lyc. Nat. Hist., 1877, 371, Big Pigeon River; not of some later papers, in which it is confounded with *S. furiosus*.

### 231. SCHILBEODES MIURUS, (Jordan).

Head 3$\frac{2}{3}$ to 4; depth 4$\frac{1}{2}$ to 5. A. 13 to 15. Body rather stout, not much elongate nor much depressed; eyes not very small; barbels moderate, about reaching gill opening, mouth moderate, the lower jaw included. Adipose fin with a deep notch, but connected with the caudal fin. Distance from snout to dorsal about 2$\frac{2}{3}$ in length. Pectoral spine 2$\frac{1}{3}$ in this distance; 1$\frac{2}{3}$ to 1$\frac{5}{6}$ in head. Dorsal nearer anal than tip of snout. Pectoral spine somewhat curved and finely serrated without, with 6 strong recurved pectinations within, each nearly as long as the diameter of the spine. Humeral process short. Body much mottled, black and grayish; top of head, tip of dorsal, middle of adipose fin, and edge of caudal definitely blackish, occiput dark; body with 4 broad cross blotches, 1 before dorsal, 1 behind it, 1 on middle of adipose fin, and 1 small one behind it. L. 4 inches. Mississippi Valley and tributaries of Lake Michigan, south to Louisiana; common in the Ohio Valley. (*μείουρος*, curtailed.)

*Noturus miurus*, Jordan, Ann. Lyc. Nat. Hist. N. Y., 1877, 371, White River, Indiana; Jordan, *l. c.*, 100, 1877; Jordan & Gilbert, Synopsis, 99, 1883.

### 232. SCHILBEODES FURIOSUS, (Jordan & Meek).

Form of *Schilbeodes miurus;* eyes rather large; barbels moderate, reaching gill opening; dorsal spine 2½ in head; pectoral spine 1¼ in head, much longer, stronger, more curved, and more heavily armed than in any other North American catfish; anterior margin of spine with many small antrorse teeth, the tip of spine without teeth; inner margin with 7 or 8 recurved hooks; adipose fin high, with a deep notch nearly to its base; caudal long, much rounded in outline. Coloration much variegated, the pattern as in *S. miurus.* Light brown, with black dots; a dusky area between eyes; a black saddle across occiput; 1 before and 1 behind dorsal, and 1 on adipose fin; a dusky bar at base of caudal; 3 dark curved streaks across caudal and 2 cross dorsal and anal. Head 3⅘; depth 5½. A. 14. L. 5 inches. Eastern North Carolina, known from the Neuse, Tar, and Little rivers. Very close to *S. miurus,* and probably a geographical variety of that species, from which it differs only in the larger spines. Its sting is more virulent than that of any other "Mad Tom." (*furiosus,* furious.)

*Noturus furiosus,* JORDAN & MEEK, Proc. U. S. Nat. Mus., 1888, 351, Neuse River, N. C. (Type, 39932.)

*Noturus eleutherus,* JORDAN & GILBERT, Synopsis 99, 1883, not type.

## 81. RHAMDIA, Bleeker.

### (BAGRES DE RIO.)

*Pteronotus,* SWAINSON, Nat. Hist. Fishes, II, 309, 1839, (*quinque-tentaculatus*); preoccupied in mollusks.

*Rhamdia,* BLEEKER, Ichth. Arch. Ind. Siluri, 1858, 197, (*quelen*).

*Pimelonotus,* GILL, Ann. Lyc. Nat. Hist. N. Y., IV, 391, 1859, (*vilsoni*).

*Notoglanis,* GÜNTHER, Cat., V, 136, 1864, (*multiradiatus*).

*Rhamdella,* EIGENMANN & EIGENMANN, Proc. Cal. Ac. Sci., 2d series, I, 129, 1888, (*eriarcha*).

Fresh water catfishes with no teeth on the vomer; the adipose fin more or less elongate; snout rather broad, not produced; barbels terete or somewhat flattened, not having a broad membranous border. Head not especially widened; occipital process small or wanting, not reaching to the dorsal plate; the fontanelle variously developed, in typical species short, not continued backward beyond the eye, except in the young, in which there are usually 2 bony bridges across the fontanelle, the one behind the eye, the other in front of the occiput; the depressions behind these bridges persistent, in some old specimens the entire fontanelle becomes obliterated. In the subgenus *Rhamdella,* the fontanelle is better developed, extending to base of occipital process. Species numerous, in streams from Mexico southward to Western Peru and the Rio de la Plata. This genus has been divided by Eigenmann into two—*Rhamdia* and *Rhamdella**—distinguished by the development of the fontanelle. As but few of the following species have been examined as to this character, we are forced to refer all to the single genus *Rhamdia*. (*Nhamdia* or *Bagre da Rio*, a Portuguese name, applied by Marcgrave to *Rhamdia sebæ*, and written "*Rhamdia*" by Valenciennes, perhaps a misprint.)

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*This genus *Rhamdella* contains those species hitherto referred to *Rhamdia* or to *Pimelodus,* in which the fontanelle is continued backward to the occipital process, with a bridge across it behind the eyes. Ventral placed below or behind the dorsal, orbit with a free margin. Two North American species, *petenensis* and *parryi,* are known to belong to *Rhamdella.* It is probable that most of the others here mentioned belong to *Rhamdella* rather than to *Rhamdia.* In Eigenmann's latest catalogue, nearly all of them are provisionally placed in *Rhamdella.*

RHAMDIA:
*a.* Fontanelle in the adult not continued behind the eye; maxillary band of teeth not widened at the edge; occipital process present.
*b.* Sides with a dark lateral band; maxillary barbels reaching little beyond front of adipose fins; pectoral spine short. WAGNERI 233.
*aa.* Species with the fontanelle undescribed, most of them probably belonging to *Rhamdella*.
*c.* Anal rays 11 or 12.
*d.* Adipose fin moderately long, 3¼ to 3⅔ in length.
*e.* Maxillary barbels very long, reaching tip of ventrals. BARONIS-MULLERI, 234.
*ee.* Maxillary barbels reaching end of dorsal.
*f.* Depth 6¼ in length. MOTAGUENSIS, 235.
*ff.* Depth 5⅓ in length. BRACHYPTERA, 236.
*dd.* Adipose fin short, 4 in length; barbels short, not reaching tip of pectorals. SALVINI, 237.
*cc.* Anal rays 13
*g.* Adipose fin short, about 4 in length; barbels reaching end of dorsal. HYPSELURUS, 238.
*gg.* Adipose fin moderate, 3 to 3½ in length.
*h.* Occipital process rather short. LATICAUDA, 239.
*hh.* Occipital process rather long. GODMANI. 240.
*ggg.* Adipose fin long, more than ⅓ of length.
*i.* Barbels very long, the longest reaching middle of adipose fin. GUATEMALENSIS, 241.
*ii.* Barbels moderate, the longest reaching front of adipose fin. NICARAGUENSIS, 242.
*iii.* Barbels shortish, the longest reaching end of dorsal. MICROPTERA, 243.
*ccc.* Anal rays 14 or 15.
*j.* Adipose fin long, more than ⅓ of length. MANAGUENSIS, 244.
*jj.* Adipose fin medium, 3⅓ in length. POLYCAULUS, 245.
RHAMDELLA, (diminutive of *Rhamdia*):
*aaa.* Fontanelle continued backward to the occipital process, with a bridge across it behind the eye.
*k.* Upper jaw scarcely longer than lower; tail deep; pectoral spine about ½ the head. PETENENSIS, 246.
*kk.* Upper jaw longer than lower; pectoral spine 2 to 2⅛ in head; dorsal spine very weak, about 2½ in head. caudal fin about 5 in length. PARRYI, 247.

## Subgenus RHAMDIA.

### 233. RHAMDIA WAGNERI, (Günther).

(BARBUDO.)

Head 4⅓; depth 5 ½ to 7. D. I, 6; A. 9 to 11. Head flat above, with vertical sides; occipital process narrow, reaching about halfway to dorsal spine; maxillary barbel variable, never reaching to end of adipose fin, sometimes little beyond base of dorsal; gill rakers 3 + 7; caudal deeply divided; its lower lobe broad and rounded, the upper pointed. Color brown, with many dark dots; a dark lateral band, darkest forward; base of dorsal pale. Rivers of Central America, on both sides of the mountains, very abundant. (Eigenmann.) (Named for Prof. Moritz Wagner, an authority in zoögeography.)

*Pimelodus wagneri*, GÜNTHER, Fishes Cent. Am., 474, 1869, Atlantic and Pacific rivers of Panama.

*Rhamdia bransfordi*, GILL, Proc. Ac. Nat. Sci. Phila., 1876, 337, Panama.

*Rhamdia wagneri*, EIGENMANN, S. A. Nematognathi, 133, 1890.

### Subgenus RHAMDELLA, Eigenmann & Eigenmann.

Besides the species ascertained by Dr. Eigenmann to belong to *Rhamdia*, the following additional species have been described from within our limits, but in none of these has the character of the fontanelle been given, so that it is impossible to say whether they belong properly to *Rhamdia* or to *Rhamdella;* most likely the majority of them will be found to have their places in the latter group:

### 234. RHAMDIA BARONIS-MULLERI, (Troschel).

Head 5 in total length. D. I, 6; A. 12; P. I, 9. Head flat, forehead broadly rounded; upper jaw the longer; maxillary barbels reaching tip of ventrals; outer mandibulary barbels to beyond base of pectorals, nearly twice as long as inner. Eye high, before middle of head; snout nearly twice length of eye; interorbital space 1½ times eye. Head covered with soft, smooth skin, occipital process narrow, pointed, covered with skin; humeral process reaching middle of pectoral spine. Body tapering backward from head, much compressed behind. Pectorals reaching to opposite third dorsal ray, the spine serrate within; ventrals shorter than pectorals, falling far short of anal, reaching halfway to base of third anal ray. Adipose fin 3½ times in the whole length. Caudal deeply divided, the lobes rounded, the lower larger. Brown, paler below, the lateral line a narrow black streak. "Pacific Ocean" in Mexico. (Troschel.) (Named for J. W. von Müller, the title "Baron" distinguishing him from the naturalist Johannes Müller.)

*Pimelodus baronis-mülleri*, TROSCHEL, in Müller's Beiträge zur Geschichte, Statistik und Zoölogie von Mexico, III, 636, 1865; no definite locality.

### 235. RHAMDIA MOTAGUENSIS, (Günther).

Head 5½; depth 6¼. D. I, 6; A. 12. Occipital process short; adipose fin 3¼ in length; maxillary barbels to end of dorsal; dorsal spine very feeble; pectoral spine striated; its inner margin strongly serrated. Caudal peduncle as high as long; caudal forked; the lower lobe rounded; the upper pointed and longer. Brownish, dorsal with a white band. Rio Motagua, Guatemala. (Günther.)

*Pimelodus motaguensis*, GÜNTHER, Cat., v, 127, 1864, Rio Motagua, Guatemala.

### 236. RHAMDIA BRACHYPTERA, (Cope).

Head 5⅔; depth 5⅓. D. I, 6; A. 11; P. I, 9. Occipital process short; maxillary barbels reaching beyond dorsal; lower jaw a little shorter; dorsal longer than high, its spine very weak; pectoral spine striate, flexible at top, strongly serrate on inner margin; adipose fin 3⅔ in body; caudal deeply emarginate; its lobes largely rounded. Blackish, a pale shade on dorsal. Orizaba, Mexico; allied to *R. motaguensis*, but with smaller eye, deeper body, and slight difference in fin rays. (Cope.) (*βραχύς*, short; *πτερόν*, fin.)

*Pimelodus brachypterus*, COPE, Trans. Am. Phil. Soc., 1866, 404, Orizaba, Mexico.

### 237. RHAMDIA SALVINI, (Günther).

Head 5; depth 6. A. 11. Occipital process short; adipose fin 4 in length; maxillary barbels short, not reaching tip of pectoral; dorsal spine very feeble; pectoral spine very short, not ⅓ head; caudal lobes subequal. Coloration plain brown. Rio San Geronimo, Guatemala. (Günther.) (Named for Oscar Salvin, who collected largely in Central America.)

*Pimelodus salvini*, GÜNTHER, Cat., v, 130, 1864, Rio San Geronimo, Guatemala.

### 238. RHAMDIA HYPSELURUS, (Günther).

Head 5; depth 6. D. I, 6; A. 13. Occipital process triangular; adipose fin 4 in length; maxillary barbels reaching to the end of dorsal. Caudal peduncle deeper than long; caudal lobes both rounded. Uniform blackish. Mexico. (Günther.) (*ὑψελός*, high; *οὐρά*, tail.)

*Pimelodus hypselurus*, GÜNTHER, Cat., v, 126, 1864, Mexico.

### 239. RHAMDIA LATICAUDA, (Heckel).

D. I, 6; A. 13. Occipital process short; adipose fin 3½ in length, maxillary barbels reaching ventral; tail about as deep as body; pectoral spine ½ as long as the rays; caudal subtruncate. Mexico. (Heckel.) (*latus*, broad; *cauda*, tail.)

*Pimelodus laticaudus*, HECKEL, in Kner, Sitz. Wien, Ac., XXVI, 420, 1857, Mexico.
*Pimelodus laticaudus*, GÜNTHER, Cat., v, 127, 1864.

### 240. RHAMDIA GODMANI, (Günther).

Head 4; depth 6. D. I, 6; A. 13. Occipital process triangular, much longer than broad. Adipose fin 3 in length. Lower jaw little shorter than upper. Pectoral spine not more than ½ head, serrated. Caudal lobes equal. Color brown; dorsal with the usual band. Valley of Rio Usumacinta, Guatemala. (Named for Mr. F. Godman, associate of Salvin.)

*Pimelodus godmani*, GÜNTHER, Cat., v, 124, 1864, Rio Usumacinta, Guatemala.

### 241. RHAMDIA GUATEMALENSIS, (Günther).

Head 4; depth 6. A. 13. Adipose fin long, 2½ in length; maxillary barbels about reaching middle of adipose fin. Dorsal spine very feeble; pectoral short, ½ as long as head; lower caudal lobe long. Blackish; dor- sal with very light band. Huamuchal, Guatemala. (Günther.)

*Pimelodus guatemalensis*, GÜNTHER, Cat., v, 122, 1864, Rio Huamuchal, Guatemala.

### 242. RHAMDIA NICARAGUENSIS, (Günther).

Head 4½; depth 7. D. I, 6; A. 13. Adipose fin 2½ in length; maxillary barbels reaching its front; pectoral spine ⅔ head. Blackish; dorsal with a faint pale band. Lake Nicaragua. (Günther.)

*Pimelodus nicaraguensis*, GÜNTHER, Cat., v, 125, 1864, Lake Nicaragua, Nicaragua.

### 243. RHAMDIA MICROPTERA, (Günther).

Head 4½; depth 7½; D. I, 6; A. 13. Occipital process slender, not reaching base of dorsal; adipose fin 2¾ in length; maxillary barbels reaching end of dorsal. Pectoral spine a little more than ½ head. Ventral very short, shorter than pectoral. Anal small; caudal short, the lower lobe 7 in body. Blackish; dorsal with a faint band. Rio San Geronimo. (Günther.) (*μικρός*, small; *πτερόν*, fin.)

*Pimelodus micropterus*, GÜNTHER, Cat., v, 124, 1864, Rio San Geronimo, Guatemala.

### 244. RHAMDIA MANAGUENSIS, (Günther).

Head 5; depth 6. D. I, 6; A. 14 or 15. Occipital process slender, not reaching basal bone of dorsal; adipose fin more than ⅓ length; maxillary barbels short, reaching nearly to base of dorsal spine; dorsal spine short. Color uniform brown; dorsal with a pale cross-band. Lake Managua, Nicaragua. (Günther.)

*Pimelodus managuensis*, GÜNTHER, Fishes Cent. Am., 474, 1869, Lake Managua, Nicaragua.

### 245. RHAMDIA POLYCAULUS, (Günther).

Head 5; depth 6. D. I, 7; A. 15. Occipital process short; adipose fin long, 3⅓ in length; maxillary barbels to tip of pectoral; dorsal spine very short; caudal lobes equal. Uniform blackish. Rio San Geronimo. (Günther.) (*πολύς*, many; *καῦλος*, stem; the number of dorsal and anal rays being greater than usual.)

*Pimelodus polycaulus*, GÜNTHER, Cat., v, 131, 1864, Rio San Geronimo.

### 246. RHAMDIA PETENENSIS, (Günther).

Head 4½; depth 6. D. I, 6; A. 11. Adipose fin low but long, more than ⅛ length, the maxillary barbels reaching to its front. Tail deep; its depth more than ½ the head. Lower jaw scarcely shorter. Dorsal spine very feeble; pectoral spine not quite ½ head. Ventral fin short, brownish, with a dark lateral band; dorsal with the usual band. Lake Peten, Yucatan. (Günther.)

*Pimelodus petenensis*, GÜNTHER, Cat., v, 126, 1864, Lake Peten, Yucatan.

### 247. RHAMDIA PARRYI, (Eigenmann).

Head 4⅗; depth 4⅓ to 5. D. I, 6; A. 12 to 14. Upper jaw longer than lower. Occipital process moderate. Dorsal spine very low and weak; 2¼ to 2¾ in head; pectoral spine 2 to 2¼ in head; caudal 4⅘ to 5⅓. Occipital process very narrow and short. Maxillary barbels short, extending little beyond dorsal fin; caudal lobe short and broad. Adipose fin 3 to 3½ in length. Brownish, a dark lateral band. Rio Zanalenco, Chiapas. (Eigenmann.) (Named for Dr. C. C. Parry, a well-known botanist.)

*Rhamdella parryi*, EIGENMANN, Proc. Cal. Ac. Sci., 1888, 130, Rio Zanalenco, Chiapas.

## 82. PIMELODELLA, Eigenmann & Eigemannn.

*Pseudorhamdia*, STEINDACHNER, Süsswasserf. Sudöstl. Bras., III, 1876, 46, (*lateristriga*); not of Bleeker, which is *Pimelodus*.

*Pimelodella*, EIGENMANN & EIGENMANN, Proc. Cal. Ac. Sci., 1888, 131, (*cristatus*).

Occipital process narrow, reaching the bony plate at base of dorsal spine. Fontanelle continued to the base of the occipital process, with a bridge across it above the posterior margin of the eye. Dorsal and pectoral spines pungent; humeral process spine-like. Dorsal rays I, 6. This genus is an ally of *Pimelodus* and *Rhamdia*. The numerous species are confined chiefly to the Amazon region. (Diminutive of *Pimelodus; πιμελής*, fat.)

*a.* Adipose fin less than ⅓ the length. D. I, 6. Pectoral fins not reaching ventral, nor ventral to anal. Pectoral spine moderate, with 8 to 15 recurved hooks.
  *b.* Sides with a dark lateral band which continues forward on the head. Tip of pectoral spine ½ diameter of the spine; spine very broad. CHAGRESI, 248.
  *bb.* Sides without dark lateral band, the color plain. Maxillary barbels reaching front of anal. MODESTA, 249.

### 248. PIMELODELLA CHAGRESI, (Steindachner).

Head 4⅔; depth 5½. D. I, 6; A. 11 or 12. Body elongate, slender. Eye 3⅔ in head. Maxillary barbels reaching front of adipose fin. Dorsal spine straight, scarcely roughened in front, except near the tip, 1½ in head. Adipose fin 3½ in length; caudal deeply forked, upper lobe much the longer. Pectoral spine flat, 1⅓ in head. Color brown, with a well-defined band from tip of snout to middle of caudal; dorsal fin with a dark bar on the membrane upon each pair of rays. Rio Chagres. (Eigenmann.)

*Pimelodus chagresi*, Steindachner, Ichth. Beitr., IV, 34, 1876, Rio Chagres, at Obispo.
*Pimelodella chagresi*, Eigenmann, *l. c.*, 130, 1888.

### 249. PIMELODELLA MODESTA, (Günther).

Adipose fin long; nearly 3 in length. Maxillary barbels reaching front of anal fin; eye 4 in head. Dorsal spine slender, little more than ½ the head, somewhat shorter than pectoral spine; caudal forked, the upper lobe the longer. (Günther.) (Esmeraldas, Ecuador; also recorded, perhaps doubtfully, from Rio Chagres.) (*modestus*, modest.)

*Pimelodus modestus*, Günther, Proc. Zoöl. Soc. Lond., 1860, 239, Esmeraldas, Ecuador. Günther, Cat., V, 117, 1864.

## 83. PIMELODUS, Lacépède.

### (Congros Barbosos.)

*Pimelodus*, Lacépède, Hist. Nat. Poiss., v, 94, 1803, (*quadrimaculatus*, etc.; includes various genera).
*Pimelodus*, Cuvier, Règne Animal, Ed. I, 203, 1817, (*quadrimaculatus*, etc.; species with one band of teeth above).
*Pimelodus*, Swainson, Class'n Fishes, etc., II, 305, 1839, (*quadrimaculatus*).
*Pimelodus*, Gill, Lütken, etc., who take *maculatus* as type.
*Pseudariodes*, Bleeker, Nederl. Tijdschr. Dierkunde, 1863, 99, (*clarias*).
*Pseudorhamdia*, Bleeker, *l. c.*, 101, 1863, (*maculatus* = *clarias*).

Teeth on the vomer in small patches or none; no teeth on palatines; pterygoid teeth sometimes present. Fontanelle not extending backward beyond the eyes. Humeral process broad, not spine-like. Crown of head granulose, or covered with thin skin. Dorsal and pectoral spines stout; adipose fin long, longer than high; dorsal rays I, 6. Species chiefly Brazilian, about 10 recognized in the genus as now restricted. (πιμελής, fat.)

### 250. PIMELODUS MACULATUS, Lacépède.

(Congro Barboso.)

Head 3½ to 4½; depth 3⅘ to 5. D. I, 6; A. 11. Head granulated, entirely naked above. Vomerine teeth none or in very minute patches; teeth on the pterygoids. Eye 5 in head; interorbital space 3¼. Maxillary barbels extending beyond tip of dorsal. Dorsal spine with its dermal tip as long as head, not quite reaching the short adipose fin, which is 3½ to 5½ times in body. Anal emarginate, some rays extending beyond tips of last rays. No brown bars on caudal; a dark cross spot at base of first dorsal spine. Rio Mamoni (Panama) and southeastward to Rio de la Plata; extremely variable, generally abundant in Brazil. (Steindachner; Eigenmann.) (*maculatus*, spotted.)

*Silurus clarias*, LINNÆUS, x, 306, 1758, in part, not the type.

*Pimelodus clarias*, STEINDACHNER, Flussfische Südamer., II, 10, 1879, and of various authors.

*Pimelodus maculatus*, LACÉPÈDE, Hist. Nat. Poiss., v, 94, 107, 1803, Rio de la Plata; GÜNTHER, Cat., v, 115, 1864, and many authors.

*Piramutana blochii*, GÜNTHER, Cat., v, 111, 1864, Cayenne, Surinam.

*Pimelodus rigidus*, SPIX, in Agassiz, Pisc. Brazil., 19, 1829, Brazil.

*Pimelodus blochii*, CUVIER & VALENCIENNES, XV, 188, 1840, after Bloch.

*Mystus ascita*, GRONOW, Cat. Fishes, 156, 1854, no locality given.

*Pimelodus macronema*, BLEEKER, Silures de Suriname, 79, pl. 14, 1864, Surinam.

*Pseudariodes pantherinus*, LÜTKEN, Meddel. Nat. Hist. Forem., 1874, Nos. 1, 2, pp. 194, 198, Venezuela.

*Pseudorhamdia piscatrix*, COPE, Proc. Am. Phil. Soc. Phila., XI, 569, 1870, Pebas.

*Piramutana macrospila*, GÜNTHER, Ann. and Mag. Nat. Hist., July, 1880, 10, pl. II, Rio de la Plata.

*Pimelodus clarias*, EIGENMANN, S. A. Nematognathi, 171, 1890.

## Family XXXV. LORICARIIDÆ.

Catfishes with sides and back covered with bony plates and with the caudal vertebræ compressed; the neural and hæmal spines expanded, forming a continuous ridge above and below. Mouth wholly inferior, provided with broad, disk-like lips. Maxillaries thin, with a terminal barbel, which is partly united with the disk at the mouth. No barbels at the chin or nostrils. Teeth, if present, hooked and usually two-lobed at the tip; the functional ones in one series; premaxillaries separate from each other, box-shaped, filled with numerous relay teeth; dentaries separate from each other and formed like the premaxillaries; no teeth on palate; no frontal or occipital fontanelle. Dorsal fin present, situated on the abdominal part of the vertebral column, not connected with the occipital process. Adipose fin, if present, composed of a spine with a thin membrane. Anal short. Gill membrane joined to the isthmus; the gill openings restricted to the sides. Intestinal canal long and coiled upon itself. Nostrils close together, a flap between them; placed a little above and in front of the eyes; iris with a flap encroaching on and sometimes dividing the pupil. Air bladder cavity narrow at the base;

expanded beneath the temporal plate, usually communicating with the outside air at a notch in the posterior margin of a temporal plate or sometimes by many holes in the temporal plate; strong movable bones or ribs extending from near the posterior end of the coalesced vertebræ outward; these compressed and sometimes forked at base; these structures form a more or less complicated arrangement which gives fixity to the dorsal spine, but prevents a lateral motion of the head. A large family of small and singularly armed catfishes, chiefly confined to the rivers of South America; 24 genera and 247 species are described by Dr. Eigenmann, who is the most recent authority on this group. (SILURIDÆ HYPOSTOMATINA in part, Günther, Cat., V, 221–260).

LORICARIINÆ:

*a.* Tail long, tapering posteriorly, with a single series of plates on the sides. Dorsal fin usually inserted behind the origin of the ventrals; no adipose fin. Intestinal canal usually not longer than body. Upper caudal lobe sometimes produced.
  *b.* Dorsal fin inserted above or slightly behind anal; 2 to 5 plates between it and occipital process. Eyes superior. Tail with strong lateral keels. Snout not expanded at tip nor margined with spines. LORICARIA, 84.

HYPOSTOMINÆ:

*aa.* Tail short, compressed or rounded. Lips entire. Adipose fin usually present; ventral surface naked, or covered with minute granular plates. Intestine greatly elongate, many times as long as the body; lower caudal lobe sometimes produced.
  *c.* Temporal plate not perforate.
    *d.* Margin of the snout granular, with sometimes a naked spot at tip. Scutes on lower surface of tail exposed. Dorsal rays I, 7; or I, 8. Teeth fine and numerous.
      *e.* Interopercle with erectile spines borne on a movable plate. Dorsal and anal distinct. HEMIANCISTRUS, 85.
  *cc.* Margin of the snout naked, without bristles, granules, or tentacles. Interopercle with erectile spines. CHÆTOSTOMUS, 86.
  *ccc.* Margin of the snout with tentacles, or, in the female, sometimes naked. Ventral surface naked. Interopercle with a bunch of spines inserted on a movable plate. ANCISTRUS, 87.

## 84. LORICARIA, Linnæus.

*Loricaria*, LINNÆUS, Syst. Nat., Ed. x, 1758, 307, (*cataphracta*).
*Sturisoma*, SWAINSON, Nat. Hist. Fishes, II, 304, 1839, (*rostrata*).
*Hemiodon*, KNER, Panzerwelse, 89, 1853, (*depressus*).
*Loricariichthys*, BLEEKER, Nederl. Tijdschr. Dierk., 80, 1863, (*dura* = *cataphracta*).
*Pseudoloricaria*, BLEEKER, *l. c.*, 80, (*læviuscula*).
*Parahemiodon*, BLEEKER, *l. c.*, 80, (*typus*).
*Hemioloricaria*, BLEEKER, *l. c.*, 81, (*caracasensis*).
*Pseudohemiodon*, BLEEKER, *l. c.*, 81, (*platycephalus*).
*Rineloricaria*, BLEEKER, *l. c.*, 81, (*lima*).
*Oxyloricaria*, BLEEKER, *l. c.*, 81, (*barbata*).

This genus, sufficiently characterized in the analytical key above, contains a very large number of species, abounding in the rivers in the eastern part of South America. They are remarkable for their elongate form and for the coat of mail which covers the body. A few of these extend northward to the waters about Panama. There is considerable variation in form among these fishes, but the different groups run into each other and are best regarded as subgenera. (*lorica*, a cuirass, or coat of mail.)

*a.* Snout long and narrow, its lower surface granular.

HEMIODON, (ἡμι, half; ὀδούς, tooth):

*b.* Margin of head in both sexes granular. Teeth minute or wanting. Lateral keels becoming parallel, not coalescing. No keels on head or scutes before dorsal.

*c.* Teeth minute, numerous in both jaws. Lower surface of head partly naked; upper and lower caudal rays greatly produced. Scales 33. PANAMENSIS, 251.

STURISOMA, (*sturio*, sturgeon; σῶμα, body):

*bb.* Margin of head in males with numerous bristles. Teeth well developed in both jaws; lateral keels coalescing.

*d.* Belly with 5 series of plates. Outer caudal rays produced. Scales 34. ROSTRATA, 252.

*aa.* Snout acute or rounded, not produced.

RINELORICARIA, (ῥίνη, rasp; *Loricaria*):

*e.* Margin of the head in males with numerous bristles. Teeth well developed. Upper caudal ray greatly produced. Lips not greatly expanded and without long cirri.

*f.* Orbit notched; head naked below.

*g.* Anal plate rather large, with 3 smaller plates before it; lower lip 2-lobed; nuchal plates each with 2 strong keels; mucous pores of anterior part of body black; all the fins spotted. LIMA, 253.

*gg.* Anal region with small scales like those on belly; nuchal ridges very low; fin rays spotted. BRANSFORDI, 254.

*ee.* Margin of the head in both sexes granular or hispid.

*h.* Plates between ventrals large; more or less connected to form a buckler.

PARAHEMIODON, (παρά, near; *Hemiodon*):

*i.* Head longer than broad. Belly with 3 or more longitudinal series of plates.

*j.* Uppermost caudal ray spinous; lower lobe emarginate with short cirri. Each jaw with 8 or 10 teeth; no keel on caudal or nuchal plates. URACANTHA, 255.

LORICARIA:

*hh.* Plates between ventrals, if present, small; no large anal plate.

*k.* Belly partly naked, the middle line and sides armed; lower lip with numerous cirri and marginal fringes; teeth few, small; an occipital keel; upper surface with light and dark lines; all fins, except anal, spotted with violet. VARIEGATA, 256.

### Subgenus HEMIODON, Kner.

### 251. LORICARIA PANAMENSIS, Eigenmann & Eigenmann.

Head 4½. D. 8; A. 6; V. I, 5. Scales 33. Lower surface of head partly naked; no keels on the head or nape; a large naked area about the mouth. Orbit without notch, 4 in snout; anterior profile concave. Belly with 5 series of plates. Upper caudal filament about as long as body; first dorsal ray very high. Brownish, a blackish area in front of eye; dorsal somewhat spotted; a stripe on each lobe of caudal. Panama. (Eigenmann).

*Loricaria panamensis*, EIGENMANN, S. A. Nematognathi, 365, 1890, Panama.

### Subgenus STURISOMA, Swainson.

### 252. LORICARIA ROSTRATA, Spix.

Head 4½. D. 8; A. 6. Scales 34. Body little depressed anteriorly; head without keels or ridges; its surfaces and plates evenly hispid; nuchal plates weakly bicarinate. Orbit without notch, 4½ in snout, 7½ in head. Anterior profile very concave; the snout long and narrow; upper lip granular; lower lip entire and rounded, elongate, papillose; free part of barbel shorter than eye. Belly with 5 series of plates; lateral keels moderate, coalescing into one at the twentieth scale; breast and lower surface with many irregular plates. First dorsal ray longer than head; outer caudal rays 3 in length. Brownish; fins mostly spotted. (Eigenmann.) Rivers of eastern South America from Panama to the Paraguay, widely distributed and abundant. (*rostratus*, long-nosed.)

*Loricaria rostrata*, SPIX, Pisc. Brazil, 5, 1829, Rio Branco; GÜNTHER, Cat., v, 256, 1864; EIGENMANN, S. A. Nematognathi, 366, 1890.

*Loricaria acuta*, CUVIER & VALENCIENNES, xv, 472, pl. 452, 1840, Barra do Rio Negro.

*Loricaria barbata*, KNER, Panzerwelse, 87, 1853, Rio Cujaba.

*Loricaria barbata*, GÜNTHER, Cat., v, 257, 1864.

### Subgenus RINELORICARIA, Bleeker.

### 253. LORICARIA LIMA, Kner.

Head 4⅜. D. 8; A. 6. Scales 27. Body depressed and elongate, the depth ½ the width. Head long, tapering; the cheeks in the male thickly covered with fine bristles; slightly rough in the female. Superciliary margins raised; nape with 2 ridges, which widen backward. Orbit with a large notch behind; anterior profile convex. Teeth few; lips well developed, the surface covered with short cirri; barbels about as long as eye. Head naked below; belly with 3 to 5 series of scutes; lateral keels coalescing at the sixteenth scute. Upper caudal ray 2⅓ in length; ventral short. Marbled above, with about 4 faint forked cross-bars. Vertical fins more or less spotted. Coastwise streams of Brazil, from the Parahyba northward to Panama, widely distributed and abundant in rocky brooks. (Eigenmann.) (*lima*, a file.)

*Loricaria lima*, KNER, Panzerwelse, 89, 1853, Brazil; GÜNTHER, Cat., v, 260, 1864; EIGENMANN, S. A. Nematognathi, 368, 1890.

*Loricaria strigilata*, HENSEL, Wiegm. Arch., 1868, 368, Santa Cruz.

### 254. LORICARIA BRANSFORDI, Gill.

Allied to *L. lima*. Scales 28. Eye small, ½ interorbital width, which is flat, bounded by slight crests; orbit with a slight notch (snout and jaws lost in typical example); lower part of head naked; opercle and marginal scutes of head with a broad dense band of erectile bristles. Scutes of neck with 2 obsolete carinæ. Scutes of thorax polygonal, those of belly scale-like; lateral ridges coalescing on eighteenth shield. Caudal fin slightly emarginate, the upper spine swollen at its basal half, the lower lobe truncated. Yellowish brown, the fin rays spotted. Isthmus of Panama. (Gill.) (Named for Dr. J. F. Bransford, its discoverer.)

*Loricaria bransfordi*, GILL, Proc. Ac. Nat. Sci. Phila., 1876, 338, Empire Station, Isthmus Railway.

### Subgenus PARAHEMIODON, Bleeker.

### 255. LORICARIA URACANTHA, Kner & Steindachner.

D. 8; A. 6. Uppermost caudal ray spinous; vertical diameter of eye 2 in interorbital width; belly with about 6 series of plates. No keels on occipital or nuchal plates; lower lip emarginate, fringed with short cirri; each jaw with 8 to 10 teeth. None of the caudal rays produced; barbels very short. Rio Chagres. (Eigenmann.) (*οὐρά*, tail; *ἄκανθα*, spine.)

*Loricaria uracantha*, KNER & STEINDACHNER, Abh. Bayr. Ac. Wiss., 56, 1865, Rio Chagres.

### Subgenus LORICARIA.

### 256. LORICARIA VARIEGATA, Steindachner.

Head 5. D. I, 7; P. I, 6; V. I, 5; A. I, 5. Lat. line, 30. Body and head strongly depressed, the head triangular, blunt forward; teeth very few, 2 on each side above, 5 or 6 below; underside of head naked. Eye 9 in head, 5 in snout; upper lobe of caudal produced in a long filament. Upper parts with many brownish streaks; fins all, except the anal, spotted with violet. Rio Mamoni, Panama. (Steindachner.) (*variegatus*, variegated.)

*Loricaria variegata*, STEINDACHNER, Flussfische Südamer., I. 15, 1879, Rio Mamoni.

## 85. HEMIANCISTRUS, Bleeker.

*Hemiancistrus*, BLEEKER, Tijdschr. Dierk., I, 78, 1863, (*medians*).
*Pseudocanthicus*, BLEEKER, *l. c.*, 79, 1863, (*serratus*).

Lips entire; tail short, compressed. Adipose fin entire; remote from the dorsal fin. Body covered with bony plates; teeth small; snout with the margin granular; temporal plate not perforate; interopercle erectile and bearing spines. The numerous species are not well known and do not seem to be abundant; they are chiefly Brazilian. (*ημι-*, half; *ἄγκιστρος*, ***Ancistrus***, a related genus.)

*a.* Interopercle with about 20 erectile spines; the longest ⅓ head. GUACHAROTE, 257.
*aa.* Interopercle with very few short, setiform spines, the longest shorter than eye, not more than $\frac{1}{10}$ head. ASPIDOLEPIS, 258.

### 257. HEMIANCISTRUS GUACHAROTE, (Cuvier & Valenciennes).

D. I, 7; A. I, 5; P. I, 6; V. I, 5. Interopercle with about 20 compressed, erectile spines, the longest ⅓ head; head depressed; snout semioval; bones of head rough, without keels; eye 5 in head; teeth very fine, doubly curved. Pectoral spine reaching first fourth of ventral; dorsal spine slender and rough. Caudal 4 in total length, forked, with pointed lobes. Belly smooth to the anal. Brownish. L. 5 inches. Porto Rico. (Cuvier & Valenciennes.) (*guacharote*, the Spanish name.)

*Hypostomus guacharote*, CUVIER & VALENCIENNES, XV, 508, 1840, Porto Rico.
*Chætostomus guacharote*, GÜNTHER, Cat., V, 245, 1864.

### 258. HEMIANCISTRUS ASPIDOLEPIS, (Günther).

Head 3⅓. D. I, 7; A. 5; P. I, 6. Lat. line, 25. Head depressed, a little longer than broad; snout very broad, rounded in front; interorbital space nearly flat, 3 times diameter of the small eye; interopercle with very few, short, setiform spines, the longest ½ eye. Thorax and belly granulated, with naked patches. Seven scales between dorsals. Pectoral spine strong, longer than head, with setiform spinules; 12 scutes between anal and caudal. Scutes of body with prominent keel, each keel with 4 to 7 short, setiform spines. Each scale variegated with dirty yellow and dark brown. Veragua. (Günther.) (*ἀσπίς*, shield; *λεπίς*, scale.)

*Chætostomus aspidolepis*, GÜNTHER, Fishes Central Amer., 478, 1869, Veragua.

## 86. CHÆTOSTOMUS, Kner.

*Chætostomus*, KNER, Hypostomiden, 272, 1853, (*loborhynchus*).

This genus, as understood by Dr. Eigenmann, includes all the forms allied to *Hypostomus* and *Hemiancistrus* in which the snout is naked. The numerous species are chiefly confined to mountain brooks in South America. (*χαίτη*, bristle; *στόμα*, mouth.)

*a.* Pectoral spine longer than head; eye 8¼ in head, 3 in snout; interopercular spines short and stout, 1 or 2 on each side. FISCHERI, 259.

### 259. CHÆTOSTOMUS FISCHERI, Steindachner.

(COUCHU.)

Head 3⅓; depth 5¾. D. I, 8; A. I, 5; V. I, 5; P. I, 6. Interopercle with 1 or 2 short but very strong curved teeth on each side. Mouth broad. Eye 8¼ in head, about 3 in snout. Pectoral spine very strong, longer than head by 1 or 2 diameters of the eye; ventral spine 1½ to 2 diameters of eye shorter than head; longest ray of caudal slightly longer than head. Scales 23 or 24. Yellowish, with very many yellow dots; fins with some faint dark spots. Rio Mamoni, near Panama. (Steindachner.) (Named for W. Fischer, who collected the type.)

*Chætostomus fischeri*, STEINDACHNER, Flussfische Südamer., I, 14, 1879, Rio Mamoni.

## 87. ANCISTRUS, Kner.

*Ancistrus*, KNER, Hypostomiden, 272, 1853, (*cirrhosus*).

This genus includes numerous species of catfishes, allied to *Hypostomus*, with the snout provided with tentacles. These tentacles are usually present in both sexes, even in the very young. (*ἄγκιστρος*, a fishhook.)

### 260. ANCISTRUS CHAGRESI, Eigenmann & Eigenmann.

Eye 6 to 7½ in head. D. I, 7; A. 4 or 5. Scales 24. Margin of the snout naked, provided with tentacles. Females with a narrow naked margin and a series of simple tentacles; male with a much wider naked area and simple marginal tentacles; thorax and belly naked; scutes of the body not keeled; region between eyes and gill openings partly naked. Opercle erectile; head broad, depressed, with keels. Lower caudal lobe scarcely longer than upper: margin of the caudal obliquely truncate. Preopercular spines 11 to 15. Breast with a small granular patch of spines. Rio Chagres. (Eigenmann.)

*Ancistrus chagresi*, EIGENMANN, Proc. Cal. Ac. Sci., 1889, 47, Rio Chagres, Panama.

## Order N. PLECTOSPONDYLI.

## (THE CARP-LIKE FISHES.)

Soft-rayed or physostomous fishes with the parietals broad, distinct; pterotic normal; symplectic present; opercular bones all present; mesocoracoid present; no interclavicles; the 4 anterior vertebræ much modified and joined together, provided with the Weberian apparatus or ossicula auditus. Branchiostegals few, usually 3 or 4; shoulder girdle attached to the skull. This group consists entirely of fresh-water fishes, and includes about 8 families, to which belong the majority of all the fresh-water fishes of the world. The essential character of the order lies in the modification of the anterior vertebræ, as in the NEMATOGNATHI, but without the character of the rudimentary subopercle and maxillary and the scaleless skin which distinguish the catfishes. Three strongly marked suborders are included in it—each of which has been sometimes regarded as a distinct order. There is no room for doubt that the EVENTOGNATHI and HETEROGNATHI, as well as the GYMNONOTI, sprang from the same stock as the catfishes, as it is not likely that the singular modification of the vertebræ, producing the Weberian apparatus has separately developed in the different groups. (*πλεκτός*, woven together; *σπόνδυλος*, vertebra.)

### ANALYSIS OF SUBORDERS OF PLECTOSPONDYLI.

*a.* Lower pharyngeals falciform, parallel with the gill arches; jaws toothless; brain case produced between orbits; basis cranii simple; only 2 superior pharyngeal bones. EVENTOGNATHI.

*aa.* Lower pharyngeals not falciform; 3 basal branchihyals; teeth in jaws often present; brain case not produced between orbits; basis cranii double, sometimes with muscular canal; 1 to 4 superior pharyngeal bones.

- *b.* Anus submedian; body not eel-shaped; dorsal fin present; ventrals abdominal. HETEROGNATHI.
- *bb.* Anus at throat; body elongate, more or less eel-shaped; dorsal obsolete; ventrals wanting. GYMNONOTI.

## Suborder EVENTOGNATHI.

### (THE CARPS.)

Plectospondylous fishes with the lower pharyngeals falciform, parallel with the gill arches; 2 upper pharyngeal bones; brain case produced between orbits; jaws without teeth; dorsal fin present; no adipose fin; ventrals abdominal. Gill openings restricted, the gill membranes attached to the isthmus. Streams and lakes of northern regions, the species excessively numerous. (*εὖ*, well; *ἐντός*, within; *γνάθος*, jaw.)

### ANALYSIS OF FAMILIES OF EVENTOGNATHI.

*a.* Pharyngeal teeth numerous, pectinate; maxillaries forming part of the margin of the upper jaw; basal branchihyals 2. CATOSTOMIDÆ, XXXVI.

*aa.* Pharyngeal teeth few; margin of upper jaw formed by premaxillaries alone; basal branchihyals 3. CYPRINIDÆ, XXXVII.

## Family XXXVI. CATOSTOMIDÆ.

### (THE SUCKERS.)

Body oblong or elongate, usually more or less compressed. Head more or less conical. Opercles normally developed. Nostrils double; no barbels; mouth large or small, usually protractile and with fleshy lips. Margin of upper jaw formed in the middle by the small premaxillaries, and on the side by the maxillaries; jaws toothless. Lower pharyngeal bones falciform, armed with a single row of numerous comb-like teeth.

Branchiostegals 3; gill membranes more or less united to the isthmus, restricting the gill openings to the sides; gills 4, a slit behind the fourth; pseudobranchiæ present. Scales cycloid, large or small. Lateral line decurved, sometimes wanting. Head naked; fins not scaly. Dorsal fin comparatively long (of 10 to 50 rays), without true spine; anal fin short; caudal fin more or less forked; ventrals abdominal, with about 10 rays; pectoral fins placed low, without spine; no adipose fin; belly not serrated. Alimentary canal long. Stomach simple; no pyloric cœca. Air bladder large, divided into 2 or 3 parts by transverse constrictions, not surrounded by a bony capsule. Genera 14; species about 60; inhabiting the fresh waters of North America; 2 species in Eastern Asia; ascending streams in large numbers in the spring. They are not much valued as food fishes, the flesh being flavorless and full of small bones. (Cyprinidæ, group Catostomina, Günther, Cat., vii, 12–24.)

*a.* Dorsal fin elongate, its developed rays 25 to 50 in number; air bladder in 2 parts.

Ictiobinæ:

- *b.* Fontanelle present; body ovate; scales large.
  - *c.* Dorsal rays 24 to 33.
    - *d.* Mouth large, more or less terminal, protractile forward; lips thin; pharyngeal bones and teeth moderate; large species, dark in color. Ictiobus, 88.
    - *dd.* Mouth smaller, inferior, protractile downward. Pharyngeal bones narrow, with the teeth thin and weak; smaller species of pale coloration. Carpiodes, 89.

Cycleptinæ:

- *bb.* Fontanelle obliterated by the union of the parietal bones; body elongate.
  - *e.* Mouth small, inferior, with thick, papillose lips; scales rather small. Cycleptus, 90.

Catostominæ:

- *aa.* Dorsal fin short, with 10 to 18 developed rays.
  - *f.* Air bladder in 2 parts.
    - *g.* Lateral line complete and continuous; scales small, 55 to 115 in the lateral line.
      - *h.* Fontanelle nearly or quite obliterated in the adult by the union of the parietal bones; jaws with hard sheaths; posterior division of air bladder slender. Pantosteus, 91.
      - *hh.* Fontanelle broad and evident at all stages of growth; posterior division of air bladder broad.
        - *i.* Nuchal region without hump, the interneural spines normally developed.
          - *j.* Mouth inferior, small, with thick papillose lips. Catostomus, 92.
          - *jj.* Mouth very large, terminal, oblique; lips thin and nearly smooth; pharyngeals weak, with numerous small teeth. Chasmistes, 93.
        - *ii.* Nuchal region with high sharp-edged hump, formed by the greatly enlarged and expanded interneural spines. Xyrauchen, 94.
    - *gg.* Lateral line interrupted or wanting; scales large (40 to 50 in longitudinal series).
      - *k.* Lateral line entirely wanting. Erimyzon, 95.
      - *kk.* Lateral line more or less developed, especially in the adult. Minytrema, 96.
  - *ff.* Air bladder in 3 parts; fontanelle present; scales large; lateral line complete.
    - *l.* Mouth normal, the lower lip entire or merely lobed, the upper protractile.
      - *m.* Pharyngeal bones moderate, the teeth compressed, gradually larger downward; mouth moderate or small, the lips usually plicate. Moxostoma, 97.
      - *mm.* Pharyngeal bones very strong, with the lower teeth much enlarged, subcylindrical and truncate, the teeth of the upper part of the bone small and compressed; mouth large, somewhat oblique, with very thick lips. Placopharynx, 98.
    - *ll.* Mouth singular, the upper lip not protractile, greatly enlarged, the lower lip developed as 2 separate lobes; pharyngeal bones and teeth ordinary. Lagochila, 99

## 88. ICTIOBUS, Rafinesque.

(Buffalo Fishes.)

*Ictiobus*, Rafinesque, Ichth. Oh., 55, 1820, (*bubalus*).
*Sclerognathus*, Cuvier and Valenciennes, xvii, 477, 1844, (*cyprinella*).
*Bubalichthys*, Agassiz, Amer. Jour. Sci. Arts, 192, 1855, (*urus*).
*Ichthyobus*, Agassiz, (corrected orthography).

Body robust; head very large and strong. Eye moderate, anterior. Fontanelle large, well open. Opercular apparatus largely developed; the suboperculum broad; the operculum strongly furrowed. Mouth large for a sucker, terminal, protractile forward, or downward and forward. Mandible strong, oblique. Lips little developed; the upper narrow and smooth; the lower rather full on the sides, but reduced to a narrow rim in front. Jaws without cartilaginous sheath. Muciferous system of head well developed. Isthmus narrow. Pharyngeal bones rather weak; the teeth numerous, moderate or small; the lower ones gradually larger than the upper ones. Gill rakers long and slender above, becoming shorter downward. Scales large, thick, nearly equal over the body; lateral line well developed, slightly decurved anteriorly. Dorsal fin elongate, its rays 25 to 30; anterior rays somewhat elevated, their length about ½ that of the base of the fin; caudal not much forked; anal fin not much elevated, its rays about 9; pectorals and ventrals moderate, the latter with about 10 rays. Sexual differences slight. Coloration dark, not silvery. Air bladder with 2 chambers. Fishes of very large size, inhabiting deep rivers, chiefly in the Mississippi basin. (*ἰχθύς*, fish; *βοῦς*, bull.)

Sclerognathus, (σκληρός, hard; γνάθος, jaw):
*a.* Mouth large, terminal, protractile forward; lips very thin; lower pharyngeals and teeth weak. cyprinella, 261.
Ictiobus:
*aa.* Mouth smaller, more or less inferior, protractile downward, and with thicker lips; lower pharyngeal bones stronger; the teeth comparatively coarse and large, increasing in size downward.
  *b.* Back scarcely elevated, the depth 3 to 3¼ in length.
    *c.* Mouth rather large and oblique, approaching that of *I. cyprinella*, more oblique than in the next. urus, 262.
    *cc.* Mouth small, inferior. meridionalis, 263.
  *bb.* Back elevated and compressed, the depth 2½ to 2¾ in length; mouth small, inferior. bubalus, 264.

### Subgenus SCLEROGNATHUS, Cuvier & Valenciennes.

### 261. ICTIOBUS CYPRINELLA, (Cuvier & Valenciennes).

(Red Mouth Buffalo Fish; Common Buffalo Fish.)

Head very large and thick, 3½ in length; depth 2½ to 3½ in length. Developed rays of the dorsal 27 to 29; anal rays 9; ventrals 10. Scales 7–37 to 41–6. Body robust, moderately compressed, the outline somewhat elliptical, but the back rather more curved than the belly. Opercular apparatus very strong, the operculum itself forming nearly ½ the length of the head. Coloration dull brownish olive, not silvery; fins dusky. Size very large; reaches a length of nearly 3 feet and a weight of 20 to 30 pounds. Mississippi Valley; generally abundant in the larger streams. (Diminutive of *cyprinus*, carp.)

*Sclerognathus cyprinella*, Cuvier & Valenciennes, xvii, 477, 1844, Lake Pontchartrain.
*Ichthyobus bubalus*, Agassiz, Amer. Jour. Sci. Arts, 1854, 196, not of Rafinesque.
*Ichthyobus cyanellus*, Nelson, Bull. Ill. Mus. Nat. Hist., i, 49, 1876, Illinois River.
*Ichthyobus bubalus*, Jordan, Bull. U. S. Nat. Mus., xii, 214, 1878.
*Sclerognathus cyprinella*, Günther, Cat., vii, 24, 1868; Jordan & Gilbert, Synopsis, 883, 1883.

## Subgenus ICTIOBUS.

### 262. ICTIOBUS URUS, (Agassiz).

(Mongrel Buffalo.)

Scales 8–41–7. D. 30; A. 10. Body much less elevated and less compressed than in *I. bubalus*, the back not at all carinated; axis of body above ventrals about at the lateral line, and but very little farther from the dorsal outline than from the ventral; depth 3 to 3¼ in length. Head very stout, strongly transversely convex, thicker, larger, and less pointed than in *I. bubalus*, about 4 in length. Eye about equal to snout, 5½ in head, much smaller than in *I. bubalus*. Mouth large, considerably oblique, opening well forward, approaching that of *I. cyprinella*. Mandible longer than eye. Premaxillary somewhat below suborbital. Dorsal fin lower and less rapidly depressed than in the next, the longest ray scarcely ½ the length of the base of the fin. Anal fin rounded; its rays not rapidly shortened; the middle ones not much shorter than the longest. Colors very dark; fins all black. Mississippi Valley; in the larger streams, less common than the others; certainly distinct from *I. bubalus*, but we can not always separate it from *I. cyprinella*, and perhaps it is not really different. (*urus*, a wild bull.)

*Carpiodes urus*, Agassiz, Amer. Jour. Sci. Arts, 1854, 355, Tennessee River, Huntsville, Ala.
*Bubalichthys urus*, *niger*, Ohio River, *and bonasus*, Osage River, Agassiz, Amer. Jour. Sci. Arts, 1855, 193, 195.
*Bubalichthys urus*, Jordan, *l. c.*, 209; Jordan & Gilbert, Synopsis, 883, 1883.

### 263. ICTIOBUS MERIDIONALIS, (Günther).

Scales 7–38–7. D. 29; A. 10. Mouth small, inferior, slightly corrugated. Depth 3⅓ to 3¼ in length. Head 4 to 4½, not much longer than high. Eye rather small, ⅕ of the length of the head and ⅖ that of the snout. Suborbitals narrow. Anterior dorsal rays not much produced, shorter than the head; caudal forked; origin of ventral vertically below the fourth dorsal ray; pectoral not extending to ventrals. Coloration uniform. Rio Usumacinta, Guatemala. (Günther.) (*meridionalis*, southern.)

*Sclerognathus meridionalis*, Günther, Cat., vii, 23, 1868, Rio Usumacinta, Guatemala.

### 264. ICTIOBUS BUBALUS, (Rafinesque).

(Small-mouthed Buffalo; Razor-backed Buffalo; Sucker-mouthed Buffalo.)

Scales 8–39–6. D. 29; A. 10; V. 10. Body considerably elevated and compressed above; the dorsal region subcarinate; belly thicker; depth 2½ to 2¾ in length; axis of body above the ventrals, below the lateral line, and nearly twice as far from the back as from the belly. Head moderate, triangular in outline when viewed from the side, 4 in length. Eye equal to snout, 4 to 5 in length of head, much larger than in *I. urus.* Mouth quite small, notably smaller and more inferior than in *I. urus;* mandible about equal to eye. Dorsal fin elevated in front and rapidly declined, the highest ray reaching much beyond the middle of the fin, the seventh ray about ½ the length of the third or longest. Anal rays rapidly shortened behind, the middle rays much shorter than the first long ones. Coloration paler; the lower fins slightly dusky. Mississippi Valley and southward; generally abundant. (*βούβαλος*, buffalo.)

*Amblodon bubalus*, RAFINESQUE, Jour. Phys., 1818, 421, Ohio River.
*Catostomus bubalus*, KIRTLAND, Rep. Zoöl. Ohio, 168, 1838.
*Bubalichthys bubalus*, AGASSIZ, Am. Jour. Sci. Arts, 1855, 195, Ohio River.
*Bubalichthys bubalus*, JORDAN, *l. c.*, 206, 1878.
*Sclerognathus urus*, GÜNTHER, Cat., VII, 22, 1868.
*Bubalichthys altus*, NELSON, in Jordan, Proc. Ac. Nat. Sci. Phila., 1877, 73, Cairo, Ill.; JORDAN & GILBERT, Synopsis, 883, 1883.
(?) *Carpiodes taurus*, Mobile River, and *C. vitulus*, Wabash River, AGASSIZ, Am. Jour. Sci. Arts, 1854, 355, 356.
*Bubalichthys bubalinus*, JORDAN, Bull. U. S. Nat. Mus., IX, 50, 1877, Ohio River.

### 89. CARPIODES, Rafinesque.

### (CARP SUCKERS.)

*Carpiodes*, RAFINESQUE, Ichth. Oh., 56, 1820, (*cyprinus*).

Head comparatively short and deep; its length 3½ to 5 times in that of the body; its upper surface always rounded. Eye moderate, median or anterior. Suborbital bones well developed. Fontanelle always well developed. Mouth small, horizontal and inferior; the mandible less than ⅓ length of head; lips thin, the upper protractile, narrow, the lower quite narrow, ∩-shaped behind; both lips feebly plicate or nearly smooth. Jaws without cartilaginous sheath. Muciferous system moderately developed. Opercular apparatus well developed; the subopercle broad. Isthmus moderate. Pharyngeal bones remarkably thin, laterally compressed, with a shallow furrow along the anterior margin on the inside, and another more central one on the outline of the enlarged surfaces; teeth very small, compressed, nearly equally thin along the whole inner edge of the bone, forming a fine, comb-like crest of minute serratures; their cutting edge rises above the inner margin into a prominent point. Gill rakers slender and stiff above, becoming reduced downward. Body oblong; the dorsal outline more or less arched; the ventral outline nearly straight; the depth from ½ to ⅓ the length; sides compressed, the back notably so. Caudal peduncle short and deep. Scales large, about equal over the body; lateral line well developed, nearly straight, with 34 to 41 scales; 12 to 15 scales in a cross-row from dorsal to ventrals. Dorsal fin beginning near middle of body, somewhat in advance of ventrals, falcate; its anterior rays elevated, often filamentous, their height ranging from ½ to 1⅓ the length of the base of the fin; the number of developed rays ranging from 23 to 30; caudal fin well forked, the lobes equal; anal fin comparatively long and low, emarginate (in males), its number of developed rays usually 8; ventrals shortish, with usually 10 rays; pectorals short. Sexual peculiarities little marked; in some species, the males in spring have the snout minutely tuberculate. Coloration always plain; pale olivaceous above, white below, but hardly silvery, the fins plain. Air bladder with two chambers. Size medium or rather large. This genus is very close to *Ictiobus* and its species are even more difficult to determine. Compared with *Ictiobus*, the *Carpiodes* are smaller in size and paler in color, with weaker dentition, but no technical character of importance separates the 2 groups. (*Carpio*, *εἶδος*, carp-like.)

*a.* Body subfusiform, the depth about 3 in length; lips thin, silvery white in life, the halves of the lower lip meeting at a wide angle. CARPIO, 265.
*aa.* Body ovate oblong, the back elevated, the depth about 2½ in length.
  *b.* Opercle strongly striate.
    *c.* Lips thin, silver-white in life, the halves of the lower lip meeting in a wide angle, as in *C. carpio.*
      *d.* Head large, with blunt snout, the nostril near its tip; eye large, 3½ to 4 in head. DIFFORMIS, 266.
      *dd.* Head small and pointed, the snout projecting; eye small, 5 to 5½ in head. THOMPSONI, 267.
    *cc.* Lips full, thick, reddish in life, the halves of lower lip meeting in an acute angle; first ray of dorsal usually very long. VELIFER, 268.
  *bb.* Opercle nearly smooth; otherwise essentially as in *C. velifer.* CYPRINUS, 269.

### 265. CARPIODES CARPIO, (Rafinesque).

(CARP SUCKER.)

Head comparatively short, its length 4 to 5 times in length of body. Body more fusiform than in the others, compressed, but not much arched, the depth 2⅔ to 3 times in length. Anterior rays of dorsal short, notably thickened and osseous at base, especially in the adult; the first ray nearer the end of the muzzle than the base of the caudal fin, the longest ray a little more than ½ the base of the fin; caudal moderately forked. Eye medium, anterior, 4½ in head. Muzzle short but projecting beyond mouth. D. 30. Lat. line 36. Size largest of the genus. Ohio Valley; southwest to central Texas, generally abundant, apparently a valid species but variable, and its synonymy uncertain. Perhaps more than one species is here included. (*carpio*, carp.)

*? Catostomus carpio*,* RAFINESQUE, Ichth. Oh., 56, 1820, Falls of Ohio River.

*Carpiodes nummifer*, COPE, Proc. Am. Phil. Soc. Phila., 1870, 484, Wabash River.

*Carpiodes carpio*, JORDAN & GILBERT; Synopsis, 118, 1883; JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1886, 20; Texas specimens.

*? Carpiodes bison*,† AGASSIZ, Am. Jour. Sci. Arts, 1854, 356, Osage River.

### 266. CARPIODES DIFFORMIS, Cope.

Snout very blunt, the maxillary reaching to front of the pupil. Nostrils very near tip of snout, above or below upper lip; lips thin, silvery colored in life, the lower ∩-shaped. Head 4¼ in length; depth 2¼ to 2¾. Eye quite large, 3½ to 4 in head. First ray of dorsal nearer muzzle than base of caudal, the anterior rays of dorsal usually very high. Scales 6–35–4. D. 24; A. 8; V. 9. Ohio Valley and westward, generally common. (*difformis*, deformed.)

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*The following is Rafinesque's description: "Diameter ¼ of the length; olivaceous above, pale beneath, chin white; abdomen bluish; lateral line straight; dorsal fin somewhat falcated with 36 rays; anal trapezoidal with 10 rays; head sloping, rounded. Seen at the Falls of the Ohio, commonly called Carp. Length from 1 to 2 feet. Eyes very small and black; fins olivaceous brown, the pectorals olivaceous, trapezoidal, short, and with 16 rays; tail with 24. Dorsal beginning before the abdominal and reaching the end of the anal fin. Not so good to eat as the Buffalo fish."

†The following is Agassiz's description: "More elongated than *C. taurus.* The head is smaller; the opercle also smaller and the subopercle triangular. The dorsal has its anterior rays longer, hence its hinder border is more deeply emarginate. Anal more lunate. Horizontal diameter of scales greater."

*Carpiodes difformis*, Cope, Proc. Am. Phil. Soc. Phila., 1870, 480, Wabash River; Jordan, *l. c.*, 195; Jordan & Gilbert, Synopsis, 120, 1883.

*Carpiodes cutisanserinus*, Cope, *l. c.*, 481, 1870, Kiskiminitas River, Pennsylvania.

### 267. CARPIODES THOMPSONI, Agassiz.

(Lake Carp.)

Body stout, short, the back much arched, the depth 2½ in length. Head small, 4 to 4¼ in length, the snout pointed; lips thin, white, meeting at a wide angle. Dorsal rays considerably elevated, ⅔ as long as base of fin. Eye small, 5 to 5½ in head. Tip of lower jaw much in advance of nostrils; maxillary reaching line of orbit. Origin of dorsal about midway of body. Scales rather closely imbricated, 8–39 to 41–6. D. 27; A. 7; V. 10. Great Lake region; abundant; our specimens from Lake Erie at Toledo, Ohio. (Named for Rev. Zadock Thompson, who found the species in Lake Champlain.)

*Carpiodes thompsoni*, Agassiz, Am. Jour. Sci. Arts, 1855, 191, Lake Champlain, Jordan, *l. c.*, 198; Jordan & Gilbert, Synopsis, 119, 1883.

? *Carpiodes selene*,* Cope, Proc. Am. Phil. Soc. 1870, 481, supposed to be from Root River, Michigan.

### 268. CARPIODES VELIFER, (Rafinesque).

(Quillback; Spearfish; Sailfish; Skimback.)

Muzzle conic, projecting, obtusely pointed; tip of the mandible reaching to opposite nostrils; maxillary reaching to opposite front of orbit. Lips full, thick, flesh-colored in life, the lower lip Λ-shaped, the halves meeting in an acute angle. Anterior suborbital as deep as long. Head 3¾ to 4 in length. Eye moderate or small, 4 to 5 in head. Body much arched above, the depth 2½ to 3 in length. First ray of dorsal usually nearer muzzle than base of caudal; anterior rays of dorsal always elevated or filamentous, sometimes as long as base of fin. Caudal deeply forked, its lobes slender, the upper the longer. Scales 7-35–5. D. 26 or 27. Mississippi Valley and southwestward to Rio Grande and upper Missouri, generally abundant and very variable. Much of the following synonymy is doubtful, some of the names perhaps belonging to *C. carpio* or *C. difformis*. (*velum*, sail; *fero*, I bear.)

*Catostomus velifer*, Rafinesque, Ichth. Oh., 56, 1820, Ohio River.

*Carpiodes velifer*, Cope, Proc. Am. Phil. Soc., 1870, 482; Jordan, *l. c.*, 196, 1878.

*Carpiodes cyprinus* and *tumidus*, Jordan & Gilbert, Synopsis, 119, 1883.

*Ictiobus velifer*, Jordan, Man. Vert., Ed. 5, 45, 1890.

*Ictiobus velifer*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1886, 18, description of var. *tumidus*, from Texas specimens.

*Carpiodes tumidus*, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1854, 28, Rio Grande at Fort Brown, Texas. (Type, No. 178.)

*Carpiodes damalis*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 170, Milk River, Montana.

*Carpiodes grayi*, Cope, Proc. Am. Phil. Soc. Phila., 1870, 482, Western States.

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*Eye 3⅗ in head; color silvery white. D. 26. This may be identical with *C. difformis*.

### 269. CARPIODES CYPRINUS, (Le Sueur).

(EASTERN CARP SUCKER.)

Very similar to *C. velifer*, the mouth similar but the opercle nearly smooth with scarcely any wrinkles or furrows. Body rather elongate. Eye quite small; dorsal fin high, color silvery, dorsal dusky; paired fins edged with white. Streams about Chesapeake Bay, common in the Chesapeake and Potomac, rare in the Delaware. (*cyprinus*, carp.)

*Catostomus cyprinus*, LE SUEUR, Jour. Ac. Nat. Sci. Phila., I, 1817. 91, Elk River and other tributaries of Chesapeake Bay; GÜNTHER, Cat., VII, 19, 1868.
*Carpiodes vacca*, AGASSIZ, Am. Jour. Sci. Arts, 1854, 256, Susquehanna River.

## 90. CYCLEPTUS, Rafinesque.

(BLACK HORSE.)

*Cycleptus*, RAFINESQUE, Jour. Phys. Chymie. Hist. Nat. Paris, 1819, 421, (*nigrescens*).
*Rhytidostomus*, HECKEL, Russeggers Reisen Syrien, 1023, 1842, (*elongatus*).

Head very small, short and slender, 6 to 7 times in body; its upper surface rounded. Eye small, behind middle of head, not very high up. Suborbital bones small and narrow. Fontanelle entirely obliterated by the union of the parietal bones. Mouth small, entirely inferior, overlapped by the projecting snout; upper lip thick, pendent, covered with several rows of tubercles; lower lip moderate, formed somewhat as in *Catostomus*, but less full, incised behind. Jaws with rudimentary cartilaginous sheath. Muciferous system not greatly developed. Operculum smooth and narrow. Isthmus moderate. Gill rakers moderate, soft. Pharyngeal bones strong; the teeth stout, increasing in size downward, rather wide apart. Body elongate, moderately compressed, not much elevated; the caudal peduncle long; scales moderate, about equal over the body, with wide, exposed surfaces, the number in the lateral line from 55 to 60. Lateral line well developed, nearly straight. Fins rather large; dorsal fin beginning in front of ventrals and ending just before anal, of about 30 rays, strongly falcate in front, the first and second developed rays in length more than ½ length of base of fin, the rays rapidly shortened to about the eighth, the remaining rays being all short; caudal fin large, widely forked, the lobes about equal. Anal fin quite small, low, of 7 or 8 developed rays, scaly at base. Ventrals moderate, with 10 rays. Pectorals elongate, somewhat falcate. Sexual peculiarities marked; the males in spring with black pigment; the head then covered with small tubercles. Air bladder with 2 chambers, the anterior short, the posterior elongate One species known. (*κύκλος*, round; *λεπτός*, slender; "the name means small round mouth."—*Rafinesque.*)

### 270. CYCLEPTUS ELONGATUS, (Le Sueur).

(BLACK HORSE; GOURD-SEED SUCKER; MISSOURI SUCKER; SUCKEREL.)

Depth 4 to 5 in length; head 6 to 8½; eye small, 6 to 7 in head. Dorsal rays 30; anal 7 or 8; scales 9–56–7. Longest dorsal rays a little longer than head; pectorals rather longer than head. Coloration very dark, the males in spring almost black. Size large. Length 2½ feet. Mississippi Valley; rather common in large streams. A singular and interesting fish. (*elongatus*, elongate).

*Catostomus elongatus*, LE SUEUR, Jour. Ac. Nat. Sci. Phila., I, 1817, 103, Ohio River.
*Sclerognathus elongatus*, GÜNTHER, Cat., VII, 23, 1868.
*Cycleptus elongatus*, JORDAN & GILBERT, Synopsis, 121, 1883.
*Cycleptus nigrescens*, RAFINESQUE, Jour. Phys., 1819, 421, Ohio River.
*Amblodon niger*, RAFINESQUE, *l. c.*, 421, (description insufficient; at second hand), Ohio River.

## 91. PANTOSTEUS, Cope.

### (MOUNTAIN SUCKERS.)

*Pantosteus*, COPE, Lieut. Wheeler's Expl. W. 100th Mer., v, 673, 1876, (*platyrhynchus*).

Head rather small, 4 to 5 times in length of body, flattish and rather broad above, anteriorly somewhat pointed. Eye rather small, usually behind the middle of the head. Suborbital bones narrow. Bones of head rather thick, the 2 parietal bones in the adult more or less united, partly or wholly obliterating the fontanelle, which, however, is evident in the young. Mouth rather large, entirely inferior; each jaw with a more or less developed cartilaginous sheath. Upper lip broad, papillose, with a rather broad free margin and 2 or more series of tubercles. Lower lip largely developed, with a broad free margin deeply incised behind. Pharyngeal bones and teeth essentially as in *Catostomus*. Isthmus broad. Body elongate, subterete, little compressed. Scales quite small, 80 to 105 in the course of the lateral line, and 30 to 35 in a cross series between dorsal and ventrals, usually more or less reduced in size and crowded forward, as in *Catostomus*. Lateral line well developed, straightish. Fins generally rather small. First ray of dorsal usually about midway of body, its rays few, 9 to 12 in number. Ventrals inserted under posterior part of dorsal, the rays 10 or 9; anal short and high, with 7 developed rays. Caudal rather shallow emarginate. Pectorals well developed. Air bladder with 2 chambers, the posterior chamber very slender. Size rather small. Rocky Mountain region, mostly in rocky brooks in the arid district. The genus is close to *Catostomus* and may be inseparable from it, as in 3 species of *Pantosteus* the fontanelle never quite disappears, retaining through life the characters of the young of other species of *Pantosteus*. This indicates the probability that *Pantosteus* is a modified descendant of species of *Catostomus*. (*πâνς*, all; *ὀστέον*, bone.)

- *a.* Fontanelle entirely obliterated in the adult.
  - *b.* Scales of back very much enlarged, there being less than 20 between dorsal fin and nape, along the median line; about 75 scales in lateral line. Head very broad, and flattish above. Gila basin. ARIZONÆ, 271.
  - *bb.* Scales of back not notably enlarged, there being 30 to 50 before dorsal.
    - *c.* Scales moderate, 80 to 90; mouth and lips moderate; dorsal rays usually 9.
      - *d.* Head short and small, nearly 5 in length; body slender. Utah basin. GENEROSUS, 272.
      - *dd.* Head rather large, about 4⅔ in length; body stout. Rio Grande. PLEBEIUS, 273.
    - *cc.* Scales very small, 90 to 100 in lateral line, usually about 95; mouth large, with very full lips; head short; tail slender; dorsal rays 9 to 12.
      - *e.* Caudal moderate, shallow-forked, its lobes shorter than head; fins low. Colorado basin. DELPHINUS, 274.

*ee.* Caudal long, deeply forked, its lobes pointed, longer than head. Head short, 5 in length. Coahuila basin. GUZMANIENSIS, 275.

*aa.* Fontanelle remaining partly open in the adult; scales small, crowded anteriorly; dorsal short (transition species, approaching *Catostomus*).

*f.* Scales in lateral line 90 to 100; head short, 4½ to 5 in length. Upper Missouri and Columbia basins. JORDANI, 276.

*ff.* Scales in lateral line about 70; lower lip more incised.

*g.* Scales before dorsal 42, the scales of the body being much crowded forward. Nevada basin. ARÆOPUS, 277.

*gg.* Scales before dorsal 23, the scales of body little crowded forward. Gila basin. CLARKI, 278.

### 271. PANTOSTEUS ARIZONÆ, Gilbert, new species.

Head $4\frac{3}{5}$; depth $4\frac{3}{4}$. D. 12; A. 7. Scales 8–75–11 to 17; unusually large scales before dorsal. Body rather robust, the caudal peduncle stoutish, compressed. Head shortish, unusually broad and flat, the interorbital very wide, flattened or even slightly concave, the orbital rim being somewhat raised; eye moderate, posterior, the snout very long, considerably longer than rest of head; eye 3 in snout, $1\frac{2}{3}$ in postorbital part of head, $5\frac{1}{2}$ in head; mouth very wide, with wide papillose lips and well-developed cartilaginous sheath to the jaws; fontanelle obliterated, the bone above it very thin; isthmus broad. Fins all comparatively large, the pectoral $1\frac{1}{10}$ in head; caudal well forked, $1\frac{1}{10}$ in head, with numerous basal rudimentary rays; edge of dorsal straight. Scales peculiar, those on back very large, those along lateral line moderate, those on belly very small, becoming minute below; scales posteriorly along lateral line much larger than anteriorly. Dark brown above, pale below. L. 9 inches. Gila basin.

*Pantosteus arizonæ*, GILBERT, MS., Salt River, Tempe, Arizona.

### 272. PANTOSTEUS GENEROSUS, (Girard).

(MOUNTAIN SUCKER.)

Body moderately elongate, the depth 5 to $5\frac{2}{3}$ in length. Head short and small, $4\frac{5}{6}$ to 5 in length. Dorsal rays 9 (rarely 10); ventral rays 10 (rarely 9); scales 15-81-14. Lower lip full, with 4 or 5 rows of tubercles; upper with 2. Isthmus very broad. Head with conspicuous mucous tubes. Lower fins large. Light brown above, with dusky spots and clouds; males with the chin and fins red, and a crimson lateral band. L. 8 inches. Great Basin of Utah; very abundant in streams about Great Salt Lake and southwest through the Sevier basin and the desert. (*Generosus*, generous.)

*Catostomus generosus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 174, Cottonwood Creek, Utah. (Type, No. 256.)

*Minomus jarrovii*, COPE, Proc. Am. Phil. Soc. Phila., 1874, 129-139, Provo River, Utah. (Type, No. 18008.)

*Pantosteus generosus*, JORDAN & GILBERT; Synopsis, 123, 1883.

*Minomus platyrhynchus*, COPE, Proc. Am. Phil. Soc. Phila., 1874, 134, Utah Lake at Provo. (Type, No. 15763.)

*Pantosteus platyrhynchus*, JORDAN & GILBERT, Synopsis, 124, 1883.

### 273. PANTOSTEUS PLEBEIUS, (Baird & Girard).

Head comparatively large, $4\frac{3}{5}$ to $4\frac{2}{3}$ in length; depth $4\frac{3}{4}$; eye 5 in head. Ventrals reaching nearly to vent. Scales moderate, scarcely crowded anteriorly, 80 in the lateral line, 25 to 30 in a cross series. Body rather stout, subfusiform. Dorsal inserted midway between snout and upper caudal rays; caudal short, emarginate. Color dark brown, faintly mottled, sides with orange in the males. L. 1 foot. Basin of the Rio Grande, Colorado to Chihuahua; very common. (*plebeius*, commonplace.)

*Catostomus plebeius*, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1854, 28, Rio Mimbres, a tributary of Lake Guzman, Chihuahua. (Type, No. 168.)

*Catostomus plebeius*, Günther, Cat., vii, 15, 1868; *Pantosteus plebeius*, Jordan, *l. c.*, 184, 1878; Jordan & Gilbert, Synopsis, 122, 1883.

*Pantosteus jarrovii*, Cope & Yarrow, but not *Minomus jarrovii*, Cope.

### 274. PANTOSTEUS DELPHINUS, (Cope).

(Blueheaded Sucker.)

Head rather short, 4⅗ to 4¾ in length; upper lip broad and pendant; lower lip very broad, more deeply incised than in *P. jordani*, the lobes pointed; tail very slender, the caudal long; mouth large, with very full lips; depth about 5 in length; scales 16–96 to 105–14. D. 10. Color dusky bluish above, males with sides more or less rosy, the snout and fins tuberculate. A curved yellowish streak extending from belly behind, and above pectoral axil. L. 12 inches. Mountain streams tributary to the Colorado River in Western Colorado and Wyoming; very abundant. (*delphinus*, dolphin.)

*Minomus delphinus*, Cope, Hayden's Geol. Sur. Wyoming for 1870, 435, 1872, probably Henry Fork of Green River, Wyoming.

*Minomus bardus*, Cope, *l. c.*, 436; locality not certain, but probably Henry Fork of Green River, Wyoming.

*Pantosteus virescens*, Cope, Wheeler Survey, Zoöl., 675, 1876, wrongly ascribed to Arkansas River at Pueblo; Jordan & Gilbert, Synopsis, 124, 1883. (Type, No. 16758.)

*Pantosteus delphinus*, Jordan, Bull. U. S. Fish Com., 1889, 19.

### 275. PANTOSTEUS GUZMANIENSIS, (Girard).

Head 5; depth 5. D. 9; A. 8. Scales 14–90–14. Body stout, little compressed. Head nearly as broad as eye; eye small, about ½ snout; mouth small; lips with considerable free margin. Dorsal inserted midway between snout and caudal; caudal deeply notched; anterior rays of dorsal longest. (Garman, description of *C. nebuliferus.)* Streams of Coahuila and Chihuahua, tributary to the Rio Grande. Possibly identical with *P. plebeius*, but the small scales and short head approach nearer *P. delphinus*, which is in a different river system.

*Catostomus guzmaniensis*,* Girard, Proc. Ac. Nat. Sci. Phila., 1856, 173; Rio Janos, a tributary of Lake Guzman, Chihuahua. (Type, No. 260.)

*Catostomus nebuliferus*, Garman, Bull. Mus. Comp. Zoöl., viii, 89, 1881, Rio Nazas, Coahuila.

*Catostomus nebulifer*, Jordan & Gilbert, Synopsis, 883, 1883.

### 276. PANTOSTEUS JORDANI, Evermann.

Head 4½ to 5½; depth 4½ to 5. Eye 4½ to 5 in head. D. 10 or 11; A. 7. Scales 16–90 to 100–14, 48 before dorsal. Body rather stout; subterete; head short, conic; interorbital space broad, little convex; snout long, 2 in head; mouth large; lower lip broad, little incised, covered with moderate

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*The type of *Catostomus guzmaniensis* is a *Pantosteus*. It has 100 scales in the lateral line, 48 scales before dorsal, the fins high. Dorsal rays 11; head 5 in length, eyes small; an orange lateral band. It is probably identical with *C. nebulifer*, from the same faunal area.

tubercles; upper lip broad, extending well down on sides of mouth, its tubercles in 3 or 4 rows; lower lip thin; more deeply incised than in *P. generosus*, the lobes rounded; the cartilaginous sheath well developed; caudal peduncle stout; scales small, much crowded forward; dorsal small, its height 1⅕ in head, a little more than base of fin; pectorals long, as long as head, reaching halfway to ventrals; ventrals short, not to vent; fontanelle a very narrow slit, or quite obliterated in old individuals; air bladder small, the posterior part very long and slender. Dark greenish, finely speckled, males with an orange lateral band; peritoneum very black. L. about a foot. Clear streams of upper Missouri and Columbia river basins, Black Hills, and northwestward. (Named for David Starr Jordan.)

*Pantosteus jordani*, Evermann, Bull. U. S. Fish Com., 1892 (Jan. 27, 1893), 51, with plate, Whitewood Creek and other streams of the Black Hills, South Dakota; Red Rock River, Red Rock, Montana, and numerous other localities. (Type, No. 43963.)
*Catostomus discobolus*, Evermann, Bull. U. S. Fish Com., 1891 (1892), 41, plate 18, fig. 1.
*Pantosteus virescens*, Jordan, Bull. 4, U. S. Nat. Mus., 1878, 780.
*Pantosteus columbianus**, Eigenmann & Eigenmann, American Naturalist, February 4, 1893, 151, Boise River, Caldwell, Idaho. (Types in Indiana University and British Museum.)
*Catostomus discobolus*, Jordan & Gilbert, Synopsis, 125, 1883; not of Cope.

### 277. PANTOSTEUS ARÆOPUS, (Jordan).

Fins moderate; dorsal higher than long, with 10, rarely 11, rays; ventral rays 10. Scales small, crowded forward, 10 or 9–70–8. Body elongate, fusiform, subterete, the greatest depth 4¼ to 4½ in length. Head small, conical, 4⅔ in length. Mouth quite large, with full, thick lips, the upper very wide and pendant, with about 6 rows of very strong papillæ; lower lip two-lobed, similarly papillose. Interorbital space wide, convex; eye elevated, posterior, quite small. Color dark; scales with dark punctulations. Kern River, California; Carson River and Reese River, Nevada. (ἀραιός, slender; ὠπή, aperture.)

*Catostomus aræopus*, Jordan, Bull. U. S. Nat. Mus., xii, 1878, 173, Kern River, California. (Type, No. 31228.)
*Catostomus aræopus*, Jordan & Henshaw, Rept. Chief Engin., App. nn., 1878, 188; Jordan & Gilbert, Synopsis, 127, 1883; Gilbert, Death Valley Expedition, 228, 1893.

### 278. PANTOSTEUS CLARKI, (Baird & Girard).

Closely related to *P. arœopus*, with restricted fontanelle and cartilaginous sheath to jaws, but with the scales less crowded anteriorly, there being but 23 before dorsal. D. 11. Scales 70; fins all small. Rio Gila and tributaries in Arizona. (Named for John H. Clark, who first collected it.)

*Catostomus clarki*, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1854, 27, Rio Santa Cruz, Gila Basin, Arizona; Jordan & Gilbert, Synopsis, 130, 1883. (Type, No. 166.)

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*Head 4⅖ to 4⅗. D. 11 or 12; A. 8. Scales 16 to 19–80 to 100–15. Eye 1½ to 2 in snout, 1⅕ to 1⅗ in interorbital, 3¾ to 4 in head. All the fins pointed, the caudal lobes considerably longer than the head. Light brown with indistinct clouds of darker. Three specimens, 92 to 100 mm. in length. Boise River, Idaho, a tributary of the Columbia. Related to *P. generosus*, the eye larger, the caudal longer. (Eigenmann.) (Named for the Columbia River.) An examination of numerous specimens from the Columbia basin shows this to be the young of *P. jordani*.

## 92. CATOSTOMUS, Le Sueur.

### (FINE-SCALED SUCKERS.)

*Catostomus*, LE SUEUR, Jour. Ac. Nat. Sci. Phila., I, 1817, 89, (*catostomus*).
*Hypentelium*, RAFINESQUE, Jour. Ac. Nat. Sci. Phila., 1818, 421, (*macropterum* = *nigricans*).
*Eurystomus*, RAFINESQUE, Ich. Oh., 59, 1820, (*megastomus*, based on an incorrect drawing).
*Decactylus*, RAFINESQUE, Ich. Oh., 60, 1820, (*bostoniensis* = *commersonii*).
*Hylomyzon*, AGASSIZ, Am. Jour. Sci. Arts, 1855, 205, (*nigricans*).
*Minomus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 173, (*insignis*).
*Acomus*, GIRARD, *l. c.*, 173, 1856, (*forsterianus*).

Head more or less elongate; eye rather small, high up; suborbital bones narrow, fontanelle always present, widely open. Mouth rather large, always inferior, upper lip thick, protractile, papillose; lower lip greatly developed, with a broad free margin, usually deeply incised behind, so that it forms 2 lobes which are often more or less separated. Mandible horizontal, short, not ⅓ the length of the head and not reaching to opposite the eye. Opercles moderate. Pharyngeal bones moderate; the teeth shortish, vertically compressed, rapidly diminishing in size upward. Body elongate, more or less fusiform, subterete. Scales comparatively small, typically much smaller and crowded anteriorly, the number in the lateral line from 50 to 115, the number in a transverse series between dorsal and ventrals from 15 to 40. Lateral line well developed, straightish. Dorsal with its first ray nearly midway of the body, with from 9 to 14 developed rays. Anal fin short and high, with 7 developed rays; ventrals inserted under the middle or posterior part of the dorsal, with 9 or 10 rays; caudal fin forked, the lobes nearly equal. Sexual peculiarities not much marked; the fins higher in the male and the anal somewhat swollen and tuberculate in the spring. Breeding males in most species with a rosy or orange lateral band. Air bladder with 2 chambers, the posterior chamber large. Vertebræ 45 to 47. Species very numerous, all belonging to the United States, except the Siberian *C. rostratus* Tilesius. Many of the western species are imperfectly known, and the following key is far from complete. (κάτω, inferior; στόμα, mouth.)

*a.* Head transversely convex above, the orbital rim not elevated; scales in lateral line 60 or more.
  CATOSTOMUS:
    *b.* Scales very small, much reduced and crowded anteriorly, the number in the lateral line 80 to 115.
      *c.* Upper lip very broad, with several (5 or 6) rows of papillæ.
        *d.* Dorsal fin of 11 to 13 rays, very high, especially in the male, the free edge of dorsal deeply incised; caudal very strong; the rudimentary rays at its base largely developed in the adult, the caudal peduncle slender; these characters all most strongly marked in adult males; lips very full. LATIPINNIS, 279.
        *dd.* Dorsal fin of 10 to 12 rays, moderately developed; caudal fin moderate, its rudimentary rays few, the peduncle rather stout; lips full; lower lip split to base. GRISEUS, 280.
      *cc.* Upper lip thick but narrow, with 3 rows of papillæ. D. 9 or 10. POCATELLO, 281.
      *ccc.* Upper lip comparatively thin and narrow with 2 to 4 rows of papillæ; dorsal rays 10 or 11.
        *e.* Scales in lateral line 95 to 115; body slender, the head long-conical; mouth narrow, lower lip split to base, but the lobes short. CATOSTOMUS, 282.
        *ee.* Scales in lateral line 83 to 87; body and head stouter. TAHOENSIS, 283.
        *eee.* Scales in lateral line 80; lower jaw strong. REX, 284.

Decactylus, (*δεκα*, ten; *δάκτυλος*, toe, *i. e.*, ventral rays).

*bb.* Scales small, but larger than in the preceding group, the number in the lateral line 56 to 75.

*f.* Scales in lateral line 70 to 75; lower lip broad.

*g.* Dorsal fin moderate, of 11 to 13 rays.

*h.* Dorsal fin short, higher than long; head rather bluntish, 4⅛ in length. LABIATUS, 285.

*hh.* Dorsal fin longer than high.

*i.* Scales before dorsal about 40; head conical, small, 4½ in length. OCCIDENTALIS, 286.

*ii.* Scales before dorsal 31; head larger, 4⅓ in length. BERNARDINI, 287.

*gg.* Dorsal fin long, of about 15 rays, head large, the lips very full. MACROCHEILUS, 288.

*ff.* Scales in lateral line 58 to 70; lips with about 4 rows of papillæ.

*j.* "Nose" little developed, not projecting much beyond the moderate mouth; mandible nearly horizontal.

*k.* Dorsal moderate, scarcely higher than long, its base 1½ to 1⅖ in head; the rays 11 to 13.

*l.* Mandible 3½ to 3⅔ in head; upper lip narrow, with usually but 3 to 5 rows of papillæ, the number greater in western specimens (var. *sucklii*); scales 10–64 to 68–9, crowded anteriorly. COMMERSONII, 289.

*ll.* Mandible 3 to 3⅓ in head; upper lip broader, with 4 to 6 rows of papillæ; scales 9–63 to 71–9, crowded anteriorly. ARDENS, 290.

*kk.* Dorsal short, distinctly higher than long, its base 1⅓ in head, its rays 11 or 12; upper lip with 4 to 6 rows of papillæ.

*m.* Scales small and crowded anteriorly, 59 in lateral line; fontanelle large. GILA, 291.

*mm.* Scales larger, little crowded anteriorly, about 56 in the lateral line, each with a dark spot at base; fontanelle small. INSIGNIS, 292.

*jj.* "Nose" largely developed, slender and projecting at an angle beyond the profile, its length 2⅙ in head; mouth small, inferior, the lips smoothish; D. 11 or 12; scales 64. (Approaches *Chasmistes.*) FECUNDUS, 293.

Hypentelium, (*ὑπό*, below; *πέντε*, five; *labium*, lip, "lower lip five-lobed"):

*aa.* Head broad, depressed, and transversely concave between orbits; scales nearly equal over the body, not crowded anteriorly 48 to 55 in the lateral line; lips very thick; lower fins large.

*n.* Head large, 4 to 4½ in length; interorbital space concave. NIGRICANS, 294.

*nn.* Head very small, 5 in length; interorbital space flattish. RHOTHŒCUS, 295.

## Subgenus CATOSTOMUS.

### 279. CATOSTOMUS LATIPINNIS, Baird & Girard.

(Flannel-mouthed Sucker.)

Depth 5¼ in the length. Head moderate, 4¾ in length, rather slender, with prominent snout and rather contracted, inferior mouth; outline of the mouth triangular, the apex forward; lips very thick, greatly developed; lower lip incised to the base; its posterior margin extending backward to opposite the eye; tubercles on lower lip smaller behind; jaws with a slight cartilaginous pellicle. Eye small, high up; the head flattish above. Scales long and low; posteriorly rounded, their horizontal diameter greater than the vertical, 17–98 to 105–17. Body slender and elongate; the caudal peduncle long and slender. Fins excessively developed, especially in the old males; the free border of the dorsal deeply incised. Height of each of the 3 vertical fins in the males greater than the length of the head. Dorsal usually 11, sometimes 12 or 13, inserted nearer snout than base of caudal. Caudal very strong, the rudimentary rays at its base unusually developed; least depth of tail less than ⅓ the head in males, stouter in females. Dark olive, abruptly paler below; sides and fins largely orange in both sexes, the anal and lower lobe of caudal tuberculate in males. Herbivorous. L. 2 feet. Rio Colorado and Rio Gila and their tributaries, very abundant, ascending the rivers in spring. Variable. (*latus*, broad; *pinna*, fin.)

*Catostomus latipinnis*, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1853, 388, Rio San Pedro, Gila Basin; Günther, Cat., vii, 14, 1868; Jordan, *l. c.*, 178, 1878; Jordan & Gilbert, Synopsis, 125, 1883. (Type, No. 20078.)

*Catostomus discobolus*, Cope, Hayden's Geol. Surv. Wyo., 435, 1870, (young), Green River, Wyoming.

### 280. CATOSTOMUS GRISEUS, (Girard).

Body long and slender, subterete, compressed behind, the form essentially that of *C. catostomus*, the depth contained 5½ times in the length. Head large, 4 in length of body; the interorbital space broad and flat, 2½ in length of head. Scales 16–90 to 110–14. Eye small, high up, and rather posterior. Mouth large, about as in *C. latipinnis*, the upper lip pendant, very large, with 5 to 8 series of tubercles; lower lip incised to base, lobes long; sheath pretty well developed. Dorsal fin not elongated, nor especially elevated, its rays 10 to 12, usually 11, the beginning of the dorsal rather nearer base of caudal than snout, much nearer in type of *C. retropinnis*. Caudal fin long and strongly forked; anal fin long and high, reaching base of caudal; ventrals not reaching vent. Caudal peduncle stout and deep, its least depth more than ⅓ length of head; its length about ⅔ that of head. Scales quite small, about as in *C. catostomus*, the exposed portion not notably lengthened. Coloration dusky brown, sometimes with a dusky lateral band, sometimes irregularly mottled or barred. Snout quite dark. Size large. Platte River and upper Missouri regions, very similar to *C. catostomus*, and perhaps not separated from it, apparently differing chiefly in the larger mouth and broader upper lip. Specimens from Gardiner River (Yellowstone Park) have larger scales, 88 to 90, representing a possible var. *lactarius*. (*griseus*, gray.)

*Acomus griseus*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 174, Sweetwater Fork of Platte River; Günther, Cat., vii, 14, 1868. (Type, No. 20257.)

? *Catostomus lactarius*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 174, Milk River, Montana; may be *C. catostomus*.

*Catostomus retropinnis*,* Jordan, Bull. U. S. Nat. Mus., xii, 178, 1878, Milk River, Montana; may possibly be a distinct species, distinguished by the fuller lips and more backward dorsal; it is probably an adult *griseus*. (Type, No. 21197.)

### 281. CATOSTOMUS POCATELLO, Gilbert & Evermann.

Head 4; depth 5 to 5⅙; eye 4½ to 5 (about 4 in young); snout 2⅓ to 2⅖ (2½ in young); interorbital width 2⅗. D. 10 (rarely 9); A. 7. Scales

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*The type of *C. retropinnis* has very much larger lips than in any other specimens we have examined, and the scales are smaller. It may be a good species.

about 96 (90 to 108 in 8 examples counted), very much reduced in size and crowded anteriorly, about 46 before the dorsal. Lateral line imperfect, often undeveloped for as much as ½ its length.

Body moderately slender; head heavy; snout not very pointed; eye rather large, high up, middle of pupil a little nearer posterior edge of opercle than tip of snout. Upper lip thick and narrow, but not pendant, 3 rows of papillæ; lower lip incised to base, the two lobes short and rounded, with about 6 rows of strong papillæ. Cartilaginous sheath of jaws not much developed. Origin of dorsal about midway between tip of snout and base of middle caudal rays; greatest height of dorsal fin 1⅗ in head, its free edge straight. Anal fin pointed, its height usually greater than that of dorsal, reaching base of caudal, 1⅓ in head; pectorals about equal to anal in length; ventrals shorter, 1⅘ in head. Least depth of caudal peduncle 2⅘ to 3 in head. Peritoneum pale, with dark punctulations. Air bladder large. This species is related to *C. griseus* (Girard), from which it may be distinguished by its heavier head, larger eye, rather narrower mouth, shorter lobes of lower lip, and the less development of the cartilaginous sheaths of the jaws. L. 8 inches. Snake River basin; the types from near Pocatello, Idaho.

*Catostomus pocatello*, GILBERT & EVERMANN, Bull. U. S. Fish Com., 1894, 159, with plate, Ross Fork of Snake River, near Pocatello, Idaho. (Type, No. 45385.)

### 282. CATOSTOMUS CATOSTOMUS, (Forster).

(LONG-NOSED SUCKER; NORTHERN SUCKER; RED SUCKER.)

Body elongate, subterete, the depth 4¼ to 4¾ in length. Head quite long and slender, 4¼ to 4⅔ in length, depressed and flattened above, broad at base, but tapering into a long snout, which considerably overhangs the large mouth. Lips thick, coarsely tuberculate, the upper lip narrow, with 2 or 3, rarely 4, rows of tubercles; lower lip deeply incised, the lobes shorter than in *C. griseus*, and the mouth narrower. Lower jaw with a slight cartilaginous sheath. Eye rather small, behind the middle of the head. Scales very small, much crowded forward, 95 to 114 in the lateral line, and about 29 (26 to 31) in a crossrow from dorsal to ventrals. Dorsal rays 10 to 11. Males in spring with the head and anal fin profusely tuberculate, the tubercles on the head small; the sides at that season with a broad rosy band. Size large. L. 2½ feet. Great Lakes, upper Missouri River, upper Columbia, and northwestward to Alaska; very abundant northward, but not coming south of lat. 40°. The most widely distributed species. (*κάτω*, below; *στόμα*, mouth.)

*Cyprinus catostomus*, FORSTER, Phil. Trans., 1773, 155, Streams about Hudson Bay.

*Catostomus longirostrum*, and *hudsonius*, after Forster, LE SUEUR, Jour. Ac. Nat. Sci. Phila., 1817, 102, 107, Vermont.

*Catostomus forsterianus*, RICHARDSON, Franklin's Journal, 1823, 720, Lake Huron; Great Slave Lake.

*Catostomus aurora*, AGASSIZ, Lake Superior, 360, 1850, Lake Superior.

*Catostomus hudsonius*, GÜNTHER, Cat., VII, 13, 1868; JORDAN, *l. c.*, 175, 1878.

*Catostomus longirostris*, JORDAN & GILBERT, Synopsis, 126, 1883.

*Catostomus nanomyzon*,* MATHER, Twelfth Rept. N. Y. Fish Com., Survey Adirondack Region, 1884, 36, Big Moose Lake, northern New York. (Type, No. 33917.)

### 283. CATOSTOMUS TAHOENSIS, Gill & Jordan.

(TAHOE SUCKER.)

Rather stouter than *C. catostomus*, the depth 4½ to 5 in length. Head very large and long acuminate, the muzzle nearly ½ its length, overhanging the rather large mouth. Lips moderate, the upper pendant, with about 3 rows of small papillæ; the lower rather full, similarly papillose. Eye nearly median, rather small, 8½ in head. Scales small and crowded forward, closely imbricated, 85 to 90 in the course of the lateral line, and about 28 in a cross series from dorsal to ventrals. Dorsal short, but longer than high, its rays 10. Coloration very dark; fins dusky; scales everywhere finely punctate. Breeding males profusely tuberculate. Size large. Lake Tahoe, very abundant. We have specimens also from Humboldt River, at Winnemucca, Nevada.

*Catostomus tahoensis*, JORDAN, *l. c.*, 173, 1878, Lake Tahoe, California (Type, No. 31226); JORDAN & HENSHAW, Rept. Chief Engin., app. nn, 1878, 188; JORDAN & GILBERT, Synopsis, 127, 1883.

### 284. CATOSTOMUS REX, R. S. Eigenmann.

Head 4; depth 4. D. 11; A. 6. Scales 13–80–8, 35 before dorsal. Head broad, flattish, the cheeks very long. Mouth small; lower jaw strong, the premaxillaries forming a hump on the snout; 2 rows of papillæ on upper lip; eye 8 in head, little behind the middle; snout 2¼ in head. Scales peculiar, covered with skin at base. Ventrals not reaching halfway to vent. Dorsal as high as long, its last rays almost as long as the first; pectorals reaching halfway to ventrals. Caudal peduncle long, terete. Lateral line interrupted behind. Teeth moderate. Blackish above, paler below; scales of belly dark-dotted; fins dark. Length of type 32 inches. Lost River, Tule Lake, Oregon. (Eigenmann.) (*rex*, king.)

*Catostomus rex*, ROSA SMITH EIGENMANN, American Naturalist, July, 1891, 667, Lost River, Oregon.

## Subgenus DECACTYLUS, Rafinesque.

### 285. CATOSTOMUS LABIATUS, Ayres.

Head 4⅓ in length, rather bluntish; mouth moderate, the labial papillæ largely developed; the upper lip full, with about 5 rows of large but rather sparse papillæ. Scales 12–74–10. Dorsal fin short, higher than long, of about 11 rays. Color dark above; sides clouded with black and yellow. Klamath Lake, Oregon; only one specimen yet known. (*labiatus*, large-lipped.)

*Catostomus labiatus*, AYRES, Proc. Cal. Ac. Sci., 1855, 32, Klamath Lake, Oregon; JORDAN, *l. c.*, 173; JORDAN & GILBERT, Synopsis, 128, 1883.

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* Thus described by Mr. Mather: "Brown; male with a red lateral band in the breeding season; head slender, flattened above, the snout shorter than in *C. catostomus;* lips thick, the lower with 3 or 4 rows of tubercles; eye large, 4 in head, 1½ in snout. Scales smaller anteriorly, but little crowded; dorsal higher than long; pectorals reaching front of dorsal; head 4; depth 5. D. I, 10. A. 7. V. 9. Scales 14–99–11; L. (spawning specimens) 4¼ inches. Big Moose Lake, Adirondack region. Apparently a dwarfed brook variety of *C. catostomus*, but inhabiting the same region and spawning at a much smaller size."

### 286. CATOSTOMUS OCCIDENTALIS, Ayres.

(Sacramento Sucker.)

Body rather slender, little elevated. Mouth comparatively small, smaller than in *C. commersonii;* the upper lip with 5 or 6 rows of smallish papillæ; lips rather thin. Head quite small, rounded above, 4½ in length, the profile steeper than in *C. commersonii;* the snout more pointed, the two sides of the head more convergent forward. Eye small. Dorsal fin longer than high, its rays 12 to 14; caudal well forked, the upper lobe the longer. Scale 13–75–10, 40 before dorsal. Dark above, gradually paler below. Streams of California; abundant in the Sacramento and San Joaquin rivers. (*occidentalis*, western.)

*Catostomus occidentalis*, Ayres, Proc. Cal. Ac. Sci., 1854, 18, San Francisco; Agassiz, Am. Jour. Sci. Arts, 1855, 209, San Francisco; Jordan, *l. c.*, 172, 1878; Günther, Cat., vii, 17, 1868; Jordan & Gilbert, Synopsis, 128, 1883.

### 287. CATOSTOMUS BERNARDINI, Girard.

Closely allied to *C. occidentalis*, but with the head less conic and the lower fins larger. Scales much crowded forward, 31 before dorsal, 75 in lateral line; fontanelle large; lips broad, without sheath, formed as in *C. occidentalis*, the lower deeply incised; fins high, the dorsal longer than high, with 12 rays; caudal lobes equal; head 4⅓ in length. San Bernardino Creek, a tributary of Rio Yaqui, on the boundary of Arizona and Sonora.

*Catostomus bernardini*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 175, San Bernardino Creek; Jordan & Gilbert, Synopsis, 128, 1883; Jordan, Cat., 18, 1885. (Type, No. 174.)

### 288. CATOSTOMUS MACROCHEILUS, Girard.

(Columbia River Sucker.)

Head 4 in length, depth 5. Scales 12–72 to 75–10, 40 before dorsal. Body heavy forward; snout blunt, much overlapping the horizontal mouth; mouth quite large, with very large lips, the upper full and pendant, with 6 to 8 rows of moderate papillæ. Head large, 4¼ in length, rather narrow, quadrangular, the snout projecting. Eye large, 6 in head. Dorsal fin much longer than high, its rays about 15; pectorals long and narrow; caudal well forked. Coloration rather dark; a dusky lateral stripe; below abruptly pale. Columbia River as far as Flathead Lake, Montana; not rare. (μακρός, large; χεῖλος, lip.)

*Catostomus macrocheilus*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 175, Astoria, Oregon; Jordan, *l. c.*, 171, 1878; Jordan & Gilbert, Synopsis, 128, 1883; Evermann, Bull. U. S. Fish Com., 1891, (1892), 40, plate 18, fig. 2. (Type, No. 240.)

### 289. CATOSTOMUS COMMERSONII, (Lacépède).

(Common Sucker; White Sucker; Brook Sucker; Fine-scaled Sucker.)

Body moderately stout, varying with age, subterete, heavy at the shoulders, the depth 4 to 4⅔ in length. Head rather large and stout, conical, flattish above, its length 4 to 4½ in body (3½ to 4¼ in young). Snout moderately prominent, scarcely overpassing the mouth. Mouth rather large; the lips strongly papillose, the upper moderate, with 2 or 3 rows of papillæ; 4 to 6 in specimens from eastern Colorado. (var. *sucklii*). Scales crowded anteriorly, much larger on the sides than below; scales 10–64 to 70–9. Coloration olivaceous; males in spring with a faint rosy lateral band; young brownish, more or less mottled, often with confluent blackish lateral blotches or a lateral band. Lateral line imperfect in the very young. D. usually 12. L. 18 inches. Streams and ponds from Quebec and the Great Lakes to Montana, Colorado, and southward to Missouri and Georgia; the commonest of the suckers, excessively abundant from Massachusetts west to Kansas. Variable; western specimens (*sucklii*) have broader lips and approach *C. Ardens.* (To Philebert Commerson, an able early French naturalist and traveler, whose collections were studied by Lacépède.)

*Cyprinus commersonii*,* Lacépède, Hist. Nat. Poiss., v, 502, 1803, locality unknown.

*Cyprinus teres*, Mitchill, Trans. Lit. and Phil. Soc. N. Y. 1815, 458, New York.

*Catostomus teres*, Günther, Cat., vii, 15, 1868; Jordan, *l. c.*, 166, 1878.

*Catostomus communis*, Delaware River, and *bostonensis*, Boston, Le Sueur, Jour. Ac. Nat. Sci. Phila., i, 1817, 95, 106, etc.

*Catostomus commersonii*, Jordan & Gilbert, Synopsis, 129, 1883.

*Catostomus flexuosus*, Rafinesque, Ich. Oh., 59, 1820, Ohio River.

*Catostomus reticulatus*, Richardson, Fauna Bor. Am: Fishes, 303, 1836, Albany River, (Scales 70 to 77).

*Catostomus gracilis*, Kirtland, Rept. Zoöl. Ohio, 168, 1838, Cleveland, Ohio, etc.

*Catostomus pallidus*, De Kay, New York Fauna: Fishes, 200, 1842, New York.

*Catostomus sucklii*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 175, Milk River, Montana.

*Catostomus chloropteron*, Abbott, Proc. Ac. Nat. Sci. Phila., 1860, 473, Kansas.

*Catostomus alticolus*, Cope & Yarrow, Wheeler Survey, Zoöl., v, 677, 1876, Twin Lakes, Colorado. (Type, Nos. 15777 and 12915.)

*Moxostoma trisignatum*, Cope, *l. c.*, 679, 1876, Arkansas River, Pueblo, Colorado.

*Catostomus utawana*,† Mather, Twelfth Report N. Y. Fish. Com., Survey of Adirondacks, 1884, 36, a dwarf form from Blue Mountain Lakes, New York. (Type, No. 33918.)

### 290. CATOSTOMUS ARDENS, Jordan & Gilbert.

(Mullet of Utah Lake.)

Head 3⅜; depth 4½. D. 12 or 13. A. 7. Scales 12–70 to 72–12. Body rather elongate, little compressed, the back broad. Head broad, conical. Mouth entirely inferior, the mandible nearly horizontal; upper lip very

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*The *Cyprinus commersonii* of Lacépède is a sucker and probably this species rather than *C. catostomus.* The description is, however, very imperfect and the type said to have been observed by Commerson in the East Indies; a statement apparently derived from a confusion of manuscripts and specimens of Commerson with those of Bosc, who collected at Charleston. Lacépède was indebted to Bosc for the next species he mentions, *Cyprinus sucetta.* Lacépède's description is as follows: "Onze rayons à la dorsale; sept à la nageoire de l'anus; neuf a chaque ventrale; huit a neuf à'chaque pectorale; la nageoire du dos et celle de l'anus quadrilatères; l'anale étroite; l'angle de l'extremité de cette derniere nageoire tres aigu; la caudale en croissant; la ligne laterale droitè; la machoire supérieure, un peu plus avancée que celle d'en bas; les écailles arrondies et très petites. Le Commersonnien dont nous publions les premiers la description, et que le savant Commerson a observé, presente un double orifice pour chaque narine; sa tête est denouée de petites écailles; ses ventrales et ses pectorales sont arrondies à leur extremité; la dorsalé s'élève vers le milieu de la longueur totale du poisson."

†The small "June sucker" of the Adirondacks thus described by Mather: "Olivaceous, white below; males without red in the breeding season; body slender; head not small, flattened above; snout little prominent; upper lip with 2 rows of papillæ; eye 4 in head, 2 in snout; dorsal as long as high; pectorals nearly reaching front of dorsal; head 4. D. I, 11; A. 5; V. 9. Scales 9–6 7–8; length of adult 4½ inches. Blue Mountain Lakes, Adirondack region. This small fish I was at first disposed to consider as a dwarfed mountain form of *C. teres*, but the fact that the latter fish is found in waters inhabited by this species, and while it grows to a length of 12 or more inches there, this little sucker barely reaches 5. Added to this the fact that the larger species had finished spawning in the inlets in May, while this fish was found in masses in the swift mountain streams which tumble rapidly over rocks in the latter part of June, depositing their eggs, thereby showing that they are adult fish."

wide, full, pendant, with 4 to 8 rows of coarse, irregular papillæ, lower lip very broad, coarsely papillose, cut to the base by a sharp incision. Eye small, 7 in head, 3½ in interorbital width; snout 2¼ in head. Dorsal fin long and low, its anterior rays ½ longer than the last rays; pectorals and ventrals short; caudal short; anal long. Pharyngeal bones rather weak, with smallish teeth. Blackish above; males with the sides rosy; fins dark. L. 18 inches. Close to *C. commersonii*, differing chiefly in the rather larger mouth and lips. Lakes and streams of great basin of Utah, swarming in myriads in Utah Lake. Also abundant in upper waters of Snake River in Idaho. In Heart Lake, in the Yellowstone Park, it is infested by a very large parasitic worm (*Ligula catostomi*, Linton), larger than its own viscera. (*ardens*, burning, from the red shades of the male.)

*Catostomus ardens*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1880, 464, Utah Lake, Provo; JORDAN & GILBERT, Synopsis, 128; JORDAN, Bull. U. S. Fish Com., 1889, 65, 77, etc; LINTON, Bull. U. S. Fish Com., 1889, 66. (Type, No. 27363.)

### 291. CATOSTOMUS GILA, Kirsch.

Head 4½; depth 4½. D. 11 or 12. Scales 11–58 to 60–10. Close to *C. ardens*, but the nape lower, the tail shorter. Dorsal shorter and higher, its longest ray nearly twice the last, and longer than base of fin; free margin incised. Snout 2¼ in head; eye small; lips large, the upper with 4 rows of papillæ, the lower split nearly to base. L. 14 inches. Dark brown, scales darker at base. Rio Gila.

*Catostomus gila*, KIRSCH, Proc. U. S. Nat. Mus., 1888, 555, Rio Gila, Fort Thomas, Arizona.

### 292. CATOSTOMUS INSIGNIS, Baird & Girard.

Body rather elongate, subterete, heavy at the shoulders, tapering backward, the depth about 5 in length. Head moderate, about 4½ in length. Fontanelle rather small; mouth comparatively small; lips moderate, the upper narrow, with several rows of large tubercles; no sheaths on jaws. Scales subequal, about 56 in the lateral line, 19 in a cross series, 27 before dorsal; scales on back large, those on belly small. A series of dusky spots along each row of scales; the spots often obscure. D. 11. Very close to *C. commersonii*, the scales less crowded, the upper lip broader, the color somewhat different. Gila basin; not rare. (*insignis*, notable.)

*Catostomus insignis*, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 28, Rio San Pedro, Arizona; COPE & YARROW, Wheeler Survey, Zoöl., v, 676, 1876; JORDAN, *l. c.*, 165, 1878; JORDAN & GILBERT, Synopsis, 130, 1883. (Type, No. 169.)

### 293. CATOSTOMUS FECUNDUS, Cope & Yarrow.

(WEBUG SUCKER.)

Head 4; depth 4½. D. 11 or 12; A. 7; V. 9. Scales 8–64–8. Body moderately stout, little compressed, the tail slender. Head subconic, the profile decurved from the nape to the base of the premaxillary spines, which abruptly protrude, forming a distinct "nose," as in *Chasmistes liorus;* premaxillaries in front scarcely below the preorbital. Mandible large, oblique, placed at an angle of 30° when the mouth is closed, its length 2¾ in head. Upper lip full, pendant, smoothish, with about 4 rows of papillæ; lower lip moderate, divided by a broad notch, each lobe with about 6 rows of papillæ. Eye a little behind middle of head. Dorsal shorter and higher than in *C. ardens*. First ray of dorsal twice height of the last, its length greater than that of the base of the fin; caudal forked, the lower lobe longest; pectorals long; anal high. Dusky above, pale below. L. a foot. Utah lake, rather scarce, and not yet seen elsewhere. This species resembles *Chasmistes liorus*. (*fecundus*, fertile, in allusion to its supposed abundance, but the "fecund" species which has made Utah Lake the "greatest sucker pond in the world" is really *C. ardens*.)

*Catostomus fecundus*, COPE & YARROW, Zoöl. Wheeler Survey, v, 678, 1876, Utah Lake; JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1880, 463; JORDAN & GILBERT, Synopsis, 129, 1883; JORDAN, Bull. U. S. Fish Com., 1889, 31. (Type, No. 16930.)

### Subgenus HYPENTELIUM, Rafinesque.

### 294. CATOSTOMUS NIGRICANS, Le Sueur.

(HOG SUCKER; STONE ROLLER; TOTER; CRAWL-A-BOTTOM; HAMMER HEAD; STONE LUGGER; HOG MOLLY.)

D. 10 or 11; V. 9. Lat. line 48 to 55, 12 to 15 scales in a cross series. Deph 4½ to 5 in length; head 4 to 4½. Eye rather small, 4½ to 5 in head. Head flattened above, transversely concave between orbits, the frontal bone thick, broad, and short, the physiognomy being therefore peculiar. Upper lip very thick, strongly papillose, with a broad free margin, which has upward of 8 to 10 series of papillæ upon it; lower lip greatly developed, strongly papillose, considerably incised behind, but less so than in *Catostomus* proper. Fontanelle shorter and smaller than in *C. commersonii*. Pectoral fins unusually larger. Color olivaceous; sides with brassy luster; belly white; back brown, with several dark cross blotches, irregularly arranged, these becoming obsolete in old individuals; lower fins dull red, with some dusky shading; young considerably variegated, the sides spotted. Size large; length about 2 feet. New York to Minnesota and Kansas, Arkansas, and the Carolinas; abundant in swift or rocky streams, which it ascends to spawn; never found in muddy or warm waters; less tenacious of life than the other species of *Catostomus*. (*nigricans*, blackish.)

*Catostomus nigricans*, LE SUEUR, Jour. Ac. Nat. Sci. Phila., 1817, 102, Lake Erie; GÜNTHER, Cat., VII, 17, 1868; JORDAN, *l. c.*, 162, 1878; JORDAN & GILBERT, Synopsis, 130, 1883.

*Hylomyzon nigricans*, AGASSIZ, Am. Jour. Sci. Arts, 1855, 205.

*Catostomus maculosus*, LE SUEUR, *l. c.*, 103, 1817, Pipe Creek, Maryland.

*Hypentelium macropterum*, RAFINESQUE, Jour. Ac. Nat. Sci. Phila., I, 1817, 420, Ohio River.

*Catostomus xanthopus*, RAFINESQUE, Ich. Oh., 57, 1820, Ohio River.

*Catostomus planiceps*, CUVIER & VALENCIENNES, XVII, 450, 1844, Wabash River.

*Catostomus nigricans etowanus*, JORDAN, Ann. Lyc. Nat. Hist. N. Y., 1877, 345, Etowah River, Rome, Ga.; a brightly colored variety from the Alabama basin.

*Catostomus megastomus*, RAFINESQUE, Ich. Oh., 59, 1820; based on an incorrect drawing; belongs here if anywhere.

### 295. CATOSTOMUS RHOTHŒCUS, Thoburn.

Head 5; depth 5. D. 11; A. 8 or 9. Scales 7–48–5, 19 rows in front of dorsal. Allied to *Catostomus nigricans* but with much smaller head, which is less depressed between eyes. Head very small, flattened above but not concave between the orbits; somewhat pointed in front, the snout projecting beyond the mouth. Width of head equal to its depth. Mouth large, its width 2¾ in head, its opening nearly a straight line. Each jaw with a strong cartilaginous sheath. Upper lip thin, with about 20 lines of minute papillæ. Lower lip broad, each lobe with 8 or 9 broken plicæ, each with minute papillæ on edges. Lobes of lower lip separated by a notch from which a strong frenum reaches to the chin. Fontanelle short, its length about ½ eye. Eye 4 in head. Pectorals large, 1⅓ length of head and reaching to the sixteenth line of scales. Dorsal inserted slightly in front of middle of body. Anal reaching beyond base of caudal. Caudal forked. Air bladder very small, with 2 chambers. Color dark olivaceous above; a darker narrow lateral band from snout below eye straight to base of caudal; the upper edge of the band obscure, the belly below the band abruptly silvery; 5 or 6 obscure dark cross bars on back and side, most distinct on the dark longitudinal stripe; base of caudal with a light band, edged behind with brown. Six specimens, 3½ to 5 inches in length, collected by Dr. Charles H. Gilbert, at some point in eastern Tennessee or southwestern Virginia, thought to be from French Broad River at Wolf Creek, Tennessee. It closely resembles *Moxostoma cervinum*, but the mouth is different. (*ῥόϑος*, torrent; *οἰκέω*, to inhabit.)

*Cotostomus rhothœcus*, THOBURN, Proc. U. S. Nat. Mus., 1894; supposed to be from French Broad River. (Type, No. 44846.)

## 93. CHASMISTES, Jordan.

*Chasmistes*, JORDAN, Bull. Hayden's Geol. Surv. Terr., IV, No. 2, 417, 1878, (*liorus*).
*Lipomyzon*, COPE, American Naturalist, January, 1881, 59, (*brevirostris*).

Head large, broad and flattish above, the sides vertical. Eyes small, high up, rather posterior. Mouth extremely large, terminal, the lower jaw in the closed mouth being very oblique, placed at an angle of about 45°; lower jaw very long and strong, its length more than ⅓ length of head, its tip, when the mouth is closed, about on a level with the eye; upper jaw very protractile; upper lip thin and nearly smooth. Snout usually elevated above the rest of head, the premaxillary spines generally forming a conspicuous nose. Lower lip moderate, consisting of a broad flap on each side of the mandible, in front reduced to a narrow rim, the surface of the lip nearly smooth, without papillæ; nostrils large. Suborbital bones narrow, but rather broader than in *Catostomus;* preorbital large; mucous channels moderately developed; fontanelle well developed. Pharyngeal bones weaker than usual in *Catostomus*, the teeth generally smaller. Fins moderate; pectorals rather long; dorsal rays 11 or 12; anal 7; anal fin high, reaching caudal; caudal fin rather long, its lobes equal. Scales moderate, large on caudal peduncle, smaller and crowded anteriorly, 60 to 80 in lateral line. Sexual peculiarities not marked. Coloration as in *Catostomus*. Air bladder in 2 parts. Size rather large. Species confined to the Great Basin. (*χασμάω*, to yawn; one who yawns.)

*a.* Scales moderate, 60 to 65 in the lateral line.
  *b.* Scales 9–63–8; dorsal rays usually 11; nose prominent. LIORUS, 296
  *bb.* Scales 13–65–11; dorsal rays 12. CUJUS, 2.

*aa.* Scales small, 70 to 80 in the lateral line.
  *c.* Snout short, the premaxillary spines not forming a distinct projecting nose; dorsal rays 11; Scales 12–74–11. BREVIROSTRIS, 298.
  *cc.* Snout long, the premaxillary spines forming a distinct projecting nose, as in *C. liorus.* Scales 12–80–9. LUXATUS, 299.

### 296. CHASMISTES LIORUS, Jordan.

(JUNE SUCKER OF UTAH LAKE.)

Head large, 3⅔ in length; depth about 5. Scales 9–63–8. Interorbital space broad, 2¼ in head; eye 6 to 7 in head; width of the open mouth 3½ in head. D. 11, the fin elevated in front, its longest ray twice the height of the last and about equal to the base of the fin. A. 7. Caudal deeply forked, the lower lobe long; lower fins small. Color dusky above, pale below; the scales of the back and sides profusely covered with dark punctulations. L. 18 inches. Utah Lake; very abundant. (λεῖος, smooth; ὅρος, margin, referring to the lips.)

*Chasmistes liorus*, JORDAN, Bull. U. S. Nat. Mus., XII, 219, 1878; Utah Lake at Provo, Utah; JORDAN & GILBERT, Synopsis, 132, 1883. (Type, No. 27361.)

### 297. CHASMISTES CUJUS, Cope.

(COUIA.)

Head broad and flat; upper lip very thin; lower lip represented by folds on each side, which do not connect around the symphysis; eye 8½ in head; interorbital space 4½. D. 12; A. 8. Scales 13–65–11. Color pale olive. Pyramid Lake, Nevada, in deep water. (Cope.) (*couia*, the Indian name.)

*Chasmistes cujus*, COPE,* Proc. Ac. Nat. Sci. Phila., 1883, 149, Pyramid Lake, Nevada.

### 298. CHASMISTES BREVIROSTRIS, Cope.

Scales 12–74–11. D. 11; A. 9. Shorter than *C. luxatus*, especially the muzzle, and the latter is without the hump produced by the protuberant premaxillary spines. Parietal fontanelle small. Lower lip fold present only on the sides of the mandible. Body nearly cylindric. Color dusky above, silvery below; fins colorless. (Cope.) L. 16 inches. Klamath Lake, Oregon. (*brevis*, short; *rostrum*, snout.)

*Chasmistes brevirostris*, COPE, American Naturalist, 1879, 785, Klamath Lake, Oregon; JORDAN & GILBERT, Synopsis, 132, 1883.

### 299. CHASMISTES LUXATUS, Cope.

Scales 12–80–9. D. 11; A. 9. Form elongate. Head long, flat above with a large fontanelle. Mouth terminal, the spines of the premaxillary projecting so as to form a hump on the top of the snout. Lower lip a very thin dermal fold, extending entirely around the chin. Color clouded above, with black punctulations, below paler, with red shades in some specimens; fins uncolored. (Cope.) L. 3 feet. Klamath Lake and River, Oregon. (*luxatus*, put out of joint, referring to the nose.)

*Chasmistes luxatus*, COPE, American Naturalist, 1879, 784, Klamath Lake, Oregon; JORDAN & GILBERT, Synopsis, 132, 1883.

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*This paper "On the Fishes of the Recent and Pliocene Lakes of the Western Part of the Great Basin and of the Idaho Pliocene Lake" contains an important discussion of the fish fauna of Nevada, Oregon, and Idaho, with description of numerous fossil forms not long extinct and closely allied to recent *Cyprinidæ* and *Catostomidæ*.

## 94. XYRAUCHEN, Eigenmann & Kirsch.

(RAZOR-BACK SUCKER.)

*Xyrauchen*, EIGENMANN & KIRSCH, Proc. U. S. Nat. Mus., 1888, 556, (*cypho*).

Characters of the genus *Catostomus* in all respects except that behind the occiput is a sharp-edged hump produced by the singularly developed interneural bones. The anterior portion of the hump is supported by a large interneural formed by a thick central pillar with anterior and posterior wings, the former coming to a point on the medial projecting plate of the supraoccipital, forming a large opening beneath it; the latter wing is somewhat smaller and articulates with the second interneural. This interneural is a thin, flat, subrectangular plate; the next is an irregular, flat plate about ½ as large as the second, while the next 3 are small, flat plates above and bent forward. Other bones of the anterior part of the skeleton are somewhat modified in form, but the essential character of the genus is in the great development of the bones at the nape, showing externally as a sharp-edged hump. Two species known; large suckers of the Colorado basin. (*ξυρός*, razor· *αὐχήν*, nape.)

*a*. Scales about 13–73–13; dorsal rays 13 or 14. Body deep, the back high, the hump commencing at the nape with no scales before it or on its edge. CYPHO, 300.

*aa*. Scales 16–81–13; dorsal rays 12; body more slender, the hump much lower; scales present before it and on its edge. UNCOMPAHGRE, 301.

### 300. XYRAUCHEN CYPHO, (Lockington).

(RAZOR-BACK SUCKER; HUMP-BACKED SUCKER.)

Head 4; depth 4. D. 13 or 14; A. 7. Scales 13 to 15–72 to 77–13. Body stout, compressed, the head low, the profile ascending to the prominent hump, which is largest in adult specimens and usually begins at the nape with no scales before it, its anterior edge straight, sharp, and scaleless; mouth wide, inferior; upper lip with 2 rows of papillæ; lower lip deeply divided, with 8 rows. Dorsal long and low, with concave edge; caudal broad and strong, with numerous rudimentary rays; pectorals moderate. Scales loosely imbricated. Pharyngeal teeth small, numerous; peritoneum black. Coloration plain olivaceous. Basin of the Colorado and Gila rivers; very abundant where the water is not too cold; reaching a weight of 8 to 10 pounds. (*cypho*, hunchback.)

*Catostomus cypho*, LOCKINGTON, Proc. Ac. Nat. Sci. Phila., 1880, 237, Colorado River at mouth of Gila, Arizona.

*Catostomus cypho*, JORDAN & GILBERT, Synopsis, 129, 1883.

*Xyrauchen cypho*, KIRSCH, Proc. U. S. Nat. Mus., 1888, 556; JORDAN, Bull. U. S. Fish Com., 1889, 26.

### 301. XYRAUCHEN UNCOMPAHGRE, Jordan & Evermann.

Head 4; depth 4⅓. D. 12; A. 7. Scales 16–81–13. Body more elongate than in *X. cypho* of the same size, the form resembling that of a *Gila*; head flatter, narrower, and less depressed than in *X. cypho*, the small lips rather larger and more coarsely tuberculate. Nuchal hump much lower than in *X. cypho*, but forming a sharp keel which does not extend forward to the nape, there being 13 scales before it, its surface also scaly.

Snout 2½ in head; breast naked; caudal peduncle much slenderer than in *X. cypho,* dorsal fin lower; caudal large. Coloration plain olivaceous. Known from a single specimen, 7 inches long, taken in Uncompahgre River (Colorado basin); possibly a variation of *X. cypho,* but quite unlike all known examples of the latter.

*Xyrauchen uncompahgre,* JORDAN & EVERMANN, Bull. U. S. Fish Com., 1889, 26, published 1891, Uncompahgre River, Delta, Colorado.

## 95. ERIMYZON, Jordan.

### (CHUB SUCKERS.)

*Moxostoma,* AGASSIZ, Am. Jour. Sci. Arts, 1854, 200, (*oblongus*), not of Rafinesque.
*Erimyzon,* JORDAN, Bull. Buffalo Soc. Nat. Hist., 1876, 95, (*oblongus*).

Body oblong, compressed. Head moderate. Mouth moderate, somewhat inferior; the upper lip well developed, freely protractile; the lower moderate, infolded, Λ-shaped in outline, plicate, with 12 to 20 folds on each side. Lower jaw without cartilaginous sheath, rather stronger than usual, and oblique when the mouth is closed. Eye moderate. Suborbital bones well developed, not much narrower than the fleshy portion of the cheek below them; opercular bones moderately developed, not rugose. Fontanelle rather large. Gill rakers rather long. Pharyngeal bones weak; the teeth quite small, slender, and weak, rapidly diminishing in length upward, each tooth narrowly compressed, with a cusp on the inner margin of the cutting surface. Scales rather large, more or less crowded forward. Lateral line entirely wanting at all ages. Dorsal fin rather short and high, rays usually 11 or 12. Pectoral fins moderate. Anal fin high and short, more or less emarginate or bilobed in adult males. Caudal fin moderately forked or merely lunate, its 2 lobes about equal. Air bladder with 2 chambers. One species; widely distributed. (ἐρι-, an intensive particle; μυζάω, to suck.)

### 302. ERIMYZON SUCETTA, (Lacépède).

### (CREEK FISH; CHUB SUCKER.)

Body oblong, compressed, becoming gibbous with age, the antedorsal region more or less elevated in the adults, the depth about 3 in length, ranging from 2½ in adults to 4 in young. Head stout, short, about 4¼ in length, the interorbital space wide. Eye rather large, 4½ head. Scales usually closely imbricated and more or less crowded forward, but often showing various irregularities in arrangement, the usual number 36–15. D. usually 12; A. 7; V. 9. Coloration varying with age; usually showing pale streaks along the rows of scales; young with a broad black lateral band, bordered above by paler; in some specimens from clear water this band is of a jet black color and very distinct; in others it is duller; later this band becomes broken into a series of blotches, which often assume the form of broad transverse bars; in adult specimens these bars disappear, and the color is nearly uniform brown, dusky above, paler below, everywhere with a coppery or brassy, never silvery, luster; the fins dusky or smoky brown, often reddish tinged. Sexual difference strong; males in spring usually with 3 large tubercles on each side of the snout, and with the anal fin more or less swollen and emarginate. Length about 10 inches. Great Lakes, Mississippi Valley, and eastward in lakes and lowland streams; very abundant; the typical form, *sucetta*, occurring coastwise from Virginia to Texas. (French *sucet*, sucker.)

*Cyprinus sucetta*, LACÉPÈDE, Hist. Nat. Poiss., v, 606, 1803, South Carolina.
*Moxostoma kennerlyi*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 171, Dry Creek, Victoria, Texas. (Type, No. 161.)
*Moxostoma campbelli*, GIRARD, *l. c.*, 172, 1856, Live Oak Creek and Devil River, Texas.
*Moxostoma tenue*, AGASSIZ, Am. Jour. Sci. Arts, 1855, 203, Mobile, Alabama.
*Erimyzon goodei*, JORDAN, Bull. U. S. Nat. Mus., XII, 148, 1878, St. Johns River, Florida.
*Erimyzon goodei*, JORDAN & GILBERT, Synopsis, 134, 1883.

Represented northward by

### 302a. ERIMYZON SUCETTA OBLONGUS, (Mitchill).

Body more elongate and less compressed than in typical *sucetta*, the greatest depth being contained about 3½ times in the length. Nape more gibbous than in *E. sucetta*. Head quite small and short, the eye smaller, about 4⅔ in head, being almost exactly midway in its length, which is 4½ in that of the body. Scales smaller and less uniform in their imbrication than in *E. sucetta*, the usual number 43–15. Color dark olivaceous above; the adult nearly plain, the young with a distinct black lateral band which breaks up into bars with age. Great Lake region to Maine and the Dakotas, south to Virginia and Indian Territory, everywhere abundant in northern upland streams, gradually passing southward into the typical *sucetta*. (*oblongus*, oblong.)

*Cyprinus oblongus*, MITCHILL, Trans. Lit. and Phil. Soc. N. Y., 1815, 1, 459, New York.
*Moxostoma oblongum*, GÜNTHER, Cat., VII, 21, 1868.
*Catostomus gibbosus*, Connecticut River, Northampton; *tuberculatus*, Germantown, Pa.; and *vittatus*, Wissahickon River, Pennsylvania, LE SUEUR, Jour. Ac. Nat. Sci. Phila., I, 1817, 92, 93, 104.
*Catostomus fasciolaris*, RAFINESQUE, Ichth. Oh., 58, 1820, Ohio River.
*Labeo elegans*, New York; *esopus*, New York; and *elongatus*, Mohawk River, DE KAY, N. Y. Fauna: Fishes, 1842, 192, 195, 394.
*Moxostoma claviformis*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 171, Coal Creek, Canadian River, Indian Territory. (Type, No. 165.)
*Erimyzon sucetta*, JORDAN & GILBERT, Synopsis, 134, 1883.

## 96. MINYTREMA, Jordan.

### (SPOTTED SUCKERS.)

*Minytrema*, JORDAN, Man. Vert. E. U. S., Ed. 2,318, 1878, (*melanops*).

Head moderate, rather broad above; mouth moderate, inferior, horizontal; the upper lip well developed, freely protractile; the lower rather small, infolded, Λ-shaped in outline, plicate. Lower jaw without cartilaginous sheath. Eye moderate, rather high, placed about midway of the head. Suborbital bones well developed. Opercular bones well developed, not much rugose. Fontanelle rather large. Gill rakers rather long. Isthmus moderate. Pharyngeal bones essentially as in *Moxostoma*. Body rather elongate, subterete, becoming deep and rather compressed with age. Scales rather large, nearly equal over the body. Lateral line interrupted in the adult, but with perfect tubes, imperfect in partly grown specimens, entirely obsolete in the young. Scales in a longitudinal series, 44 to 47 in number, 12 to 14 in a transverse series. Dorsal fin rather short and high, with about 12 rays beginning rather nearer snout than base of caudal. Pectoral fins moderate. Anal high and short, more or less emarginate in males. Caudal fin moderately forked, the lobes about equal. Air bladder with 2 chambers. Males in spring with the head covered with many small tubercles. This genus is intermediate between *Erimyzon* and *Moxostoma*, differing from the latter mainly in the structure of its air bladder. (*μινύς*, reduced; *τρῆμα*, aperture; in allusion to the imperfections of the lateral line.)

*a.* Dark streaks along rows of scales evident; scales 7–46–6. MELANOPS, 303.

### 303. MINYTREMA MELANOPS, (Rafinesque).

(WINTER SUCKER; SPOTTED SUCKER.)

Body oblong, little compressed, the young nearly terete, the adults deeper; depth about 4 in length, varying from about 3 in adults to 4½ in the young. Head not very large, 4⅓ in length of body (4¼ to 4½), not specially depressed. Mucous pores rather strong. Eye small, 5 to 6 in head. Scales large, firm, regularly and smoothly imbricated, in 46 (44 to 47) longitudinal series, and 13 (12 to 14) transverse series, the scales not crowded forward. Fin rays usually, D. 12; A. 7; V. 9. Coloration dusky above, with usually a black blotch behind the dorsal fin; each scale along the sides with a small, more or less distinct blackish spot at its base, these spots forming interrupted longitudinal lines along the rows of scales; these lines are usually very distinct, especially in the adult, but young specimens often show them faintly; sides and belly silvery, with a coppery luster. Sexual peculiarities moderately marked; very old males with the head covered with small tubercles in spring; no great change with age, either in form or coloration. Size large; maximum length about 18 inches. Great Lake region to North Carolina (Cape Fear River) and west to Texas; rather common westward. (*μέλας*, black; *ὤψ*, appearance.)

*Catostomus melanops*, RAFINESQUE, Ichth. Oh., 57, 1820, Ohio River.
*Catostomus fasciatus* LE SUEUR, in Cuvier & Valenciennes, XVII, 449, 1844, Mississippi River.
*Catostomus fasciatus*, GÜNTHER, Cat., VII, 19, 1868; JORDAN, Bull. U. S. Nat. Mus. XII, 138, 1878.
*Minytrema melanops*, JORDAN & GILBERT, Synopsis, 136, 1883.
*Moxostoma victoriæ*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 171, Dry Creek, Victoria, Texas.
*Ptychostomus haydeni*, GIRARD, *l. c.*, 1856, 172, Yellowstone River; Missouri River at Fort Pierre, Nebraska. (Type, No. 20263.)

## 97. MOXOSTOMA, Rafinesque.

(RED HORSE.)

*Moxostoma*, RAFINESQUE, Ichth. Oh., 54, 1820, (*anisurus*).
*Teretulus*, RAFINESQUE, *l. c.*, 57, 1820, (*aureolus*).
*Ptychostomus*, AGASSIZ, Am. Jour. Sci. Arts, 1855, 203, (*aureolus*).

Body more or less elongate, sometimes nearly terete, usually more or less compressed. Head variously long or short, its length 3½ to 5½ in that of the body. Eye usually rather large, from 3 to 6 times in the length of the head. Suborbital bones very narrow. Fontanelle always well open. Mouth varying much in size, always inferior in position, the mandible being horizontal or nearly so. Lips usually well developed, the form of the lower varying, usually with a slight median fissure, but never deeply incised; the lips with transverse plicæ, the folds rarely so broken up as to form papillæ. Jaws without cartilaginous sheath. Muciferous system considerably developed. Opercular bones moderately developed, nearly smooth. Isthmus broad. Gill rakers weak, moderately long. Pharyngeal bones rather weak, much as in *Erimyzon* and *Catostomus*, the teeth rather coarser, strongly compressed, the lower 5 or 6 stronger than the others, which rapidly diminish in size upward, each with a prominent internal cusp. Scales large, more or less quadrate in form, nearly equal in size over the body, and not specially crowded anywhere, usually about 44 in the lateral line and about 12 series between dorsal and ventrals. Lateral line well developed, straight or anteriorly curved. Fins well developed, the dorsal inserted about midway of body, its first rays usually rather nearer snout than caudal, the number of developed rays usually about 13, but varying from 11 to 17. Anal fin short and high, usually emarginate in the male, with 7 developed rays. Caudal fin deeply forked. Air bladder with 3 chambers. Skeleton essentially as in *Catostomus*, the vertebræ (in *M. anisurum*) 27 + 14 = 41. Sexual peculiarities little marked, the males in the spawning season with the lower fins reddened, and the anal rays swollen and somewhat tuberculate. Species very numerous in the United States east of the Rocky Mountains. They spawn in spring, running up from the rivers into the smaller streams for that purpose. They are difficult to distinguish and have been unduly multiplied by authors. They are less tenacious of life than the species of *Catostomus*. (*μυζάω*, to suck; *στόμα*, mouth; hence, more properly *Myzostoma*.)

- *a.* Lips full, the folds broken up into evident papillæ; mouth very small, the snout projecting. D. 12 to 14. PAPILLOSUM, 304.
- *aa.* Lips plicate, the folds not forming distinct papillæ.
  - *b.* Dorsal fin large, of 15 to 18 rays; lower lip V-shaped, somewhat papillose.
    - *c.* Mouth moderate; lower fin pale. ANISURUM, 305.
    - *cc.* Mouth quite small; lower fin reddish. COLLAPSUM, 306
  - *bb.* Dorsal fin smaller, of 10 to 14 rays.
    - *d.* Lower lip narrow, infolded, V-shaped when seen from below, with a distinct median crease in which the halves meet, forming an acute angle.
      - *e.* Body stout, with broad, bluntish head, which is flattened above; dorsal rays 12. BUCCO, 307.
      - *ee.* Body elongate, subcylindrical, little compressed; snout truncate. PIDIENSE, 308.
      - *eee.* Body compressed, the back elevated; muzzle projecting beyond the very small mouth. COREGONUS, 309.
    - *dd.* Lower lip thin, forming a narrow, crescent-shaped border around the mandible.
      - *f.* Head small, 5 in length; snout prominent; dorsal rays 12 to 14. ALBUM, 310.
      - *ff.* Head stout, 4 in length; snout not projecting; dorsal rays 14 or 15. THALASSINUM, 311.
    - *ddd.* Lower lip full, truncate behind, not evidently V-shaped or U-shaped.
      - *g.* Dorsal fin moderate, its rays 12 to 14, usually 13 in number; body more or less compressed.
        - *h.* Caudal fin normal, the 2 lobes similarly colored.
          - *i.* Caudal fin with the upper lobe not conspicuously longer than the lower.

*j.* Head rather large, stout, broad above, 4 to nearly 5 in body; snout little projecting beyond the mouth.

*k.* Dorsal fin low and small, its first ray when depressed reaching middle of last, the number of rays 12; mouth small. CONGESTUM, 312.

*kk.* Dorsal fin rather high and pointed, its first ray about reaching tip of last, its rays but 11 ; mouth rather small. AUSTRINUM, 313.

*kkk.* Dorsal fin larger and longer, its rays usually 13.

*l.* Dorsal fin with its free margin nearly straight; lower fins always red in life.

*m.* Body oblong or rather elongate, the back little elevated. AUREOLUM, 314.

*mm.* Body stout, the back much elevated. ROBUSTUM, 315.

*ll.* Dorsal fin with its free margin always more or less incised or concave; lower fins pale.

*n.* Head moderate, 4⅗ in body; back not elevated. MACROLEPIDOTUM, 316.

*nn.* Head very short and blunt, 5 in body; back elevated. CRASSILABRE, 317.

*j.* Head short, low and small, conic, 5 to 5½ in body; mouth very small, the snout much projecting beyond it; caudal lobes apparently equal. LESUEURI, 318.

*ii.* Caudal fin with the upper lobe more or less produced and falcate; snout much projecting beyond the small mouth; head small and conic, about 5¼ in length; dorsal fin with the free border incised, the first rays produced.

*o.* Lower fins red in life; eye small, 5 in head. BREVICEPS, 319.

*oo.* Lower fins pale; eye larger. CONUS, 320.

*hh.* Caudal with the lower lobe distinctly longer than the upper, and jet black, the 2 lower rays abruptly pale; upper lobe red; body elongate; mouth moderate. PŒCILURUM, 321.

*gg.* Dorsal fin small, its rays 10 to 12 in number; body elongate, subterete, or slightly compressed; head shortish; mouth moderate.

*p.* Scales 6–50–6, 18 before dorsal; dorsal with its free edge concave; color nearly plain brownish, tips of dorsal and caudal somewhat dusky. RUPISCARTES, 322.

*pp.* Scales 6–43–5, 15 before dorsal; series of pale streaks along rows of scales; tips of dorsal and caudal inky black. CERVINUM, 323.

### 304. MOXOSTOMA PAPILLOSUM, (Cope).

(WHITE MULLET.)

Body comparatively stout, the dorsal region somewhat elevated and rounded, the depth 4 to 4½ in length, the head about the same. Eye rather large, high up and well back, the preorbital space being longer than in most species; top of head flat. Dorsal rays 12 to 14. Scales rather large, 6–42–5. Lips moderate, deeply incised, the folds more broken up than in other species. Caudal lobes equal. Color silvery; back with smoky shading; lower fins more or less reddish. Size moderate, length 1 to 2 feet. Coastwise streams from the Dismal Swamp in Virginia to the Ocmulgee River, Georgia; common. (*Papillosus*, bearing papillæ.)

*Ptychostomus papillosus*, COPE, Proc. Am. Phil. Soc. Phila., 1870, 470, Catawba and Yadkin rivers, North Carolina.

*Moxostoma papillosum*, JORDAN, Bull. U. S. Nat. Mus., XII, 134, 1878; JORDAN & GILBERT, Synopsis, 137, 1883.

### 305. MOXOSTOMA ANISURUM, (Rafinesque).

(White-nosed Sucker.)

Body stout, deep, compressed, the back elevated, the depth 3 to 4 in length. Head short, heavy, flattish and broad above, 3¾ to 4¼ in length; depth of cheeks ½ length of head. Eye rather large, midway in head, 4 to 5 in its length. Muzzle rather prominent, bluntish, overhanging the rather large mouth; upper lip thin, lower strongly **V**-shaped; fins very large. Dorsal long and high, its height ⅚ the length of head, its free border straight, the first ray about as long as fin. Pectorals nearly reaching ventrals; upper lobe of caudal narrow, longer than lower. D. 15 to 18. Color very pale and silvery; smoky above; lower fins white or pale red. Size large. Ohio River and Great Lake region; not very common, but widely distributed. (*ἄνισος*, unequal; *οὐρά* tail.)

*Catostomus anisurus*, Rafinesque, Ichth. Oh., 54, 1820, Ohio River.
*Catostomus carpio*, Cuvier & Valenciennes, xvii, 457, 1844, Lake Ontario, not of Rafinesque.
*Catostomus carpio*, Günther, Cat., vii, 20, 1868.
*Moxostoma carpio*, Jordan & Gilbert, Synopsis, 139, 1883.
*Ptychostomus velatus*, Cope, Proc. Am. Phil. Soc. Phila., 1870, 471, Youghiogheny River, Pennsylvania.
*Moxostoma velatum*, Jordan & Gilbert, Synopsis, 138, 1883.
*Moxostoma valenciennesi*, Jordan, Proc. U. S. Nat. Mus., 1885, 73, substitute for *carpio*, preoccupied.
*Moxostoma anisurum*, Jordan, Man. Vert., Ed. 5, 47, 1890.

### 306. MOXOSTOMA COLLAPSUM, (Cope).

Head 4; depth 3⅓. D. 15. Scales 6–42–5. Body rather stout, compressed, the back elevated. Head short, small, conic, broad and flat above. Mouth small, the lips plicate, the lower lip **Λ**-shaped. Muzzle truncate, overhanging the mouth. Eye in middle of side of head, 4 in its length (in specimen of 8 inches), ½ in snout, 1½ in interorbital. Depth of cheek, ½ length of head back to preopercle. Dorsal long, its free edge straight, its first ray as long as its base, ⅚ length of head. Caudal lobes subequal. Silvery, dusky above, without dark spots on bases of scales; dorsal and caudal membranes blackish; other fins plain, said to be orange in life. (H. M. Smith.) Lowland streams of North Carolina (Neuse, Catawba, Yadkin, and Roanoke); said to be very abundant. Apparently very close to *M. anisurum*, but with the mouth smaller; perhaps not distinct. (*collapsus*, flattened sidewise.)

*Ptychostomus collapsus*, Cope, Proc. Am. Phil. Soc., 1870, 471, Neuse, Yadkin, and Catawba rivers, North Carolina.
*Moxostoma collapsum*, Smith, Bull. U. S. Fish Com., 1891, 198.

### 307. MOXOSTOMA BUCCO, (Cope).

Head short and very wide through the opercles; front and vertex flat. Body stout, the back somewhat elevated; depth 4 in length. Muzzle subtruncate, slightly projecting. Lips thin, the lower with lateral lobes inclosing a **Λ**-shaped interval. Eye large, 3½ in head, width of head behind orbits 1¾ in its length. Scales 6–40–5. D. 12; A. 7; V. 9. Olivaceous, silvery below; dorsal fin dusky. (Cope.) Missouri River at St. Joseph. Type about 4 inches long; a doubtful species said to be allied to *Moxostoma collapsum,* but the dorsal has fewer rays. It is possible that this is a valid species between *anisurum* and *pidiense,* but no species with the ʌ-shaped lips of *anisurum* have been found in the Missouri River by other collectors. It will not unlikely prove to be a young red horse or possibly the young of *Minytrema melanops.* (*bucco,* thick cheeks, from the interopercular width of the head.)

*Ptychostomus bucco,* Cope, Hayden's Geol. Surv. Wyoming, 1872, 437, St. Joseph, Missouri.
*Moxostoma bucco,* Jordan & Gilbert, Synopsis, 138, 1883.

### 308. MOXOSTOMA PIDIENSE, (Cope).

Head rather long, 4½ in length, flattish above. Body elongate, more nearly cylindrical, little compressed. Muzzle truncate. Olivaceous, sometimes with rows of faint spots along the series of scales; dorsal and caudal fins black-edged. Size quite small. Resembles *M. cervinum* but the mouth entirely different. Great Pedee Basin. (Cope.) (Name from Pedee.)

*Ptychostomus pidiensis,* Cope, Proc. Am. Phil. Soc. Phila., 1870, 471, Yadkin River, North Carolina.
*Moxostoma pidiense,* Jordan, Bull. U.S. Nat. Mus., xii, 133, 1878; Jordan & Gilbert, Synopsis, 138, 1883.

### 309. MOXOSTOMA COREGONUS, (Cope).

(Blue Mullet.)

Muzzle conic, much projecting beyond the very small mouth; body much compressed, broadly fusiform, the back elevated and arched. Dorsal rays 14. Color silvery, with plumbeous shades above; lower fins white. Size small. Catawba and Yadkin rivers, North Corolina. (Cope.) (*coregonus,* the white fish, from the form.)

*Ptychostomus coregonus,* Cope, Proc. Am. Phil. Soc. Phila., 1870, 472, Catawba and Yadkin rivers.
*Moxostoma coregonus,* Jordan, Bull. U.S. Nat. Mus., xii, 134, 1878; Jordan & Gilbert, Synopsis, 139, 1883.

### 310. MOXOSTOMA ALBUM, (Cope).

Head small, 5 in length. Muzzle prominent, but less so than in *M. coregonus.* Mouth moderate. Back a little elevated. Depth about 3⅓ in length. Dorsal rays 12 to 14, its free border often incised. Scales 6–45–5. Coloration very pale; lower fins white. Size large; reaches a weight of 4 pounds or more. Catawba and other rivers of North Carolina. (*albus,* white.)

*Ptychostomus albus,* Cope, Proc. Am. Phil. Soc. Phila., 1870, 472, Catawba River, North Carolina.
*Moxostoma album,* Jordan, Bull. U. S. Nat. Mus., xii, 130, 1878; Jordan & Gilbert, Synopsis, 139, 1883.

### 311. MOXOSTOMA THALASSINUM, (Cope).

Head stout, as in *M. anisurum,* rather long, 4 in length, flattish above, muzzle truncate, not very prominent. Mouth moderate. Back elevated.

Dorsal fin long, of 14 or 15 rays. Green above, white below; lower fins white. Yadkin River. (Cope.) (*thalassinus*, sea green.)

*Ptychostomus thalassinus*, COPE, Proc. Am. Phil. Soc. Phila., 1870, 472, Yadkin River, North Carolina.

*Moxostoma thalassinus*, JORDAN, Bull. U. S. Nat. Mus., XII, 131, 1878; JORDAN & GILBERT, Synopsis, 139, 1883.

### 312. MOXOSTOMA CONGESTUM, (Baird & Girard).

(TEXAS RED HORSE.)

Head 4½ to 4¾; depth 4. D. 12. Scales 6–45–5. General form of *M. aureolum*, rather robust, moderately compressed, the back somewhat elevated. Head comparatively short, rather broad above and pointed anteriorly; the snout a little projecting, mouth rather small, the lower lip full, formed as in *M. aureolum;* eye small, about 5 in head; dorsal fin unusually low and small, little elevated in front, its first ray, when depressed, reaching about to middle of last ray; caudal not deeply forked, the lobes equal; lower fins moderate. Smoky yellowish brown above, yellowish silvery below; lower fins whitish; none of the fins red in life; the membranes of the dorsal always dusky. Teeth as in *M. aureolum*. Streams of Texas (our specimens from Lampasas River), said to have been taken in Ash Creek, Arizona, but this is doubtful. The types of *congestum* and *albidum* belong to this species, which is close to *macrolepidotum*. (*congestus*, swollen.)

*Catostomus congestus*, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 27, Rio Salado, Texas.

*Ptychostomus albidus*,* GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 172, Rio San Juan, Monterey, New Leon. (Type, No. 170.)

*Moxostoma albidum*, JORDAN & GILBERT, Synopsis, 141, 1883; JORDAN, Proc. U. S. Nat. Mus., 1886, 18.

*Catostomus texanus*, ABBOTT, Proc. Ac. Nat. Sci. Phila., 1860, 473, Colorado and New rivers, Texas.

### 313. MOXOSTOMA AUSTRINUM, Bean.

Head 4⅓; depth 4. D. 11; A. 6. Scales 6–44–6. Body rather stout; lips plicate, truncate behind. Fontanelle very small. Eye small, nearly 6 in head. Dorsal rather high, its margin concave, its first ray when depressed nearly reaching end of last ray. Air bladder in 3 parts. Light brown above, yellowish below, some scales brownish at base; paired fins with dark blotches in the adult, these markings wanting in the young which is nearly plain silvery. Basin of Rio de Santiago, Michoacan, Mexico (west of Sierra Madre). Our specimen from Rio Lerma, at Salamanca. (aus(*trinus*, southern.)

*Myxostoma austrina*, BEAN, Proc. U. S. Nat. Mus., 1879, 302, Piedad in Morelia, (Michoacan), Mexico. (Type, Nos. 23120 and 23121.)

*Minytrema austrinum*, JORDAN & GILBERT, Synopsis, 136, 1883.

### 314. MOXOSTOMA AUREOLUM, (Le Sueur).

(COMMON RED HORSE; MULLET; WHITE SUCKER; LARGE-SCALED SUCKER.)

Head comparatively elongate, bluntish, rather broad and flattened above, 4 to 5 in length, its size somewhat variable. Body stoutish, varying to moderately elongate. Lips rather full, the bluntish muzzle projecting beyond the large mouth; greatest depth of cheeks more than ½ distance from snout to preopercle. Eye rather large. Dorsal fin medium, its developed rays 12 to 14, usually 13 in number, its free edge nearly straight, its longest ray shorter than head. Scales large, about 45 in the lateral line. Olivaceous; sides silvery; lower fins in the adult red or orange. Lake Ontario and Lake Michigan to the Missouri River, south to Arkansas and Georgia; everywhere abundant west of the Allegheny mountains. This perhaps may vary into *M. macrolepidotum*, of which it has been considered a variety, but for the present at least we think it best to regard it as distinct. (*aureolus*, gilded.)

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* The type specimen of *Ptychostomus albidus* has 44 scales in the lateral line, instead of 56, as represented in Girard's figure.

*Catostomus aureolus*,* Le Sueur, Jour. Ac. Nat. Sci. Phila., i, 95. 1817, Lake Erie, near Buffalo.
*Catostomus erythrurus*, Rafinesque, Am. Month. Mag., 1818,354, Ohio River.
*Catostomus duquesni*, Günther, Cat., vii, 18, 1868.
*Catostomus oneida*,† De Kay, N. Y. Fauna: Fishes, 198, 1842, Oneida Lake.
*Rutilus melanurus*, Rafinesque, Ich. Oh , 51, 1820, Ohio River.
*Ptychostomus duquesnei*,‡ *erythrurus*, *oneida*, etc., Cope, Proc. Am. Phil. Soc. Phila, 1870.
*Myxostoma euryops*, Jordan, Ann. Lyc. Nat. Hist. N. Y., 1876, 348, Oostanaula River, Rome, Georgia, is probably a monstrosity of this species.

### 315. MOXOSTOMA ROBUSTUM, (Cope).

Body stout, the back elevated. Head short and deep; the snout not prominent, truncate in profile. Eye 4 to 5 in head. Dorsal short, its upper margin straight. D. 12. Head 4 to 4½ in length. Color smoky or clouded above, with golden reflections, yellowish below; dorsal, anal, and caudal dark crimson. Size large, weight 6 pounds or more. Yadkin River, North Carolina. (Cope). A doubtful species, apparently resembling *M. aureolum*, and perhaps identical with it. (*robustus*, robust.)

*Ptychostomus robustus*, Cope, Proc. Am. Phil. Soc. Phila., 1870, 473, Yadkin River, North Carolina.

### 316. MOXOSTOMA MACROLEPIDOTUM, (Le Sueur).

Head moderate, rather stout, its length 4⅗ in body, eye 1⅔ in snout; dorsal fin with its free edge concave. Scales usually with dusky shade at base; lower fins pale. Streams about Chesapeake and Delaware bays, and southward to North Carolina. It seems in some respects intermediate between *M. aureolum* and *M. crassilabre*, but we can not at present identify it with either. (*μακρολεπιδοτός*, large-scaled.)

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* *C. aureolus.*—"Anal fin long, pointed and passing considerably beyond the base of the caudal fin, which is forked, with pointed lobes, the inferior of which is the largest; abdominal fin truncated. Body subcylindric, elevated at the nape; head quadrangular, gibbous above the eye, almost as high as long; the rays of the anal fin are very strong and large; scales rhomboidal, equal; body of a beautiful orange color, which is deepest on the back, the bases of the scales dark red; the sides are heightened with golden reflections; pectoral, ventral and anal fins of a fine red orange, caudal fin of a deep carmine color—the dorsal fin is paler than the rest; the lateral line is nearly straight, and commences in a line with the eye. Length of individual described 16 inches, its depth 3 inches and its thickness 2½ inches. P. 18. D. 14. V. 9. A. 8. C. 18. This beautiful species I discovered near Buffalo on Lake Erie."—*Le Sueur.*
There is no reason for supposing this to be anything other than the common Red Horse. The name *Moxostoma aureolum* has been applied by us to short-headed specimens of Red Horse, but we have never felt sure that these were specifically distinct from the ordinary sort. Some specimens thus named probably belong to *Moxostoma breviceps.*

† *Moxostoma oneida* (De Kay), a species with the back much arched, the head small, nearly 5 in total length with caudal; eye small, 6 in head; mouth inferior. Bluish above, paler below. D. 13. Oneida Lake (De Kay). This is probably identical with *M. aureolum.*

‡ *C. duquesnei*, Le Sueur has been usually identified with this species. It seems, however, more likely to have been what has usually been called *Placopharynx carinatus.*

*Catostomus macrolepidotus*,* Le Sueur, Jour. Ac. Nat. Sci. Phila., 1, 94, 1817, Delaware River.
*Ptychostomus lachrymalis*,† Cope, Proc. Am. Phil. Soc. Phlia., 1870, 474, Neuse River, at Newbern, N. C.

### 317. MOXOSTOMA CRASSILABRE, (Cope).

Body robust, the back elevated and compressed. Head short, broad, flattish above, mouth moderate, the lips full; lower, truncate behind; snout short, little projecting. Scales large, 5–44–5. Dorsal rays usually 13. Head 5; depth $3\frac{1}{3}$; dorsal fin elevated in front, its edge much incised; its first soft ray longer than the base of the fin and about as long as head. Caudal lobes equal. Color silvery, with smoky shading above, some of the scales blackish at their bases; anal and caudal with some red; top of head, humeral bar, and a broad shade across dorsal fin, dusky. Streams of eastern North Carolina, our specimens from Little River at Goldsboro, a tributary of the Neuse. (*crassus*, thick; *labrum*, lip.)

*Ptychostomus crassilabris*, Cope, Proc. Am. Phil. Soc. Phila., 1870, 477, Neuse River, Raleigh.
*Moxostoma crassilabre*, Jordan & Gilbert, Synopsis, 140, 1883.
*Moxostoma crassilabre*, Jordan, Bull. U. S. Fish Com. for 1888, 128.

### 318. MOXOSTOMA LESUEURI, (Richardson).

(Picconou.)

A species from the far north, allied to *M. breviceps*, with short head and small mouth. As it is unknown to us, we copy from Richardson the following "description of recent specimens at Cumberland House, April, 1820:

"Color: Back, sides, and gill covers wood brown, reflecting when opposed to the light many brilliant tints, in which emerald green and gold yellow predominate; bases of the scales bluish gray, producing an appearance of reticulation; belly reddish white. The dorsal has the hue of the back with a reddish margin, the other fins are almost entirely red.

"Scales large, quadrangular with parallel sides and irregularly curved ends; their length and breadth nearly equal. Except in the pectoral region, where they are small, their size when *in situ* appears nearly the same over the whole body; the vertical height of their uncovered portion considerably exceeds its length. A linear inch measured longitudinally on the sides includes 3 scales, but vertically only 2. There are 47 scales on the lateral line, and about 10 in a vertical line under the dorsal. A scale detached from near the lateral line above the ventals measures 8½ lines in length, and 7½ in width. The lateral line turns up decidedly at the anal as in *C. hudsonius* (*Catostomus catostomus*).

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* *C. macrolepidotus.* "Dorsal fin short, greatly hollowed, upper lobe elevated and pointed, lower lobe rounded. Body a little compressed and fusiform, elevated on its anterior part, rounded near the nape; head somewhat declivous and longer than deep; anal fin straight, long, and passing the base of the caudal; pectoral and abdominal fins small; caudal fin forked, with pointed lobes, and of a gray color; dorsal, anal, and ventral fins tinted with blue and yellow; scales large and disposed in a lozenge form; color of the back dark blue, base of the scales brown; sides whitish, with yellow reflections; opercula yellowish; head reddish brown; the lateral line rises at the nape of the neck, descends along the gill cover, and thence to the tail in a line with the center of the eye. Found in the river Delaware. P. 18. D. 16. V. 9. A. 9. C. 18 $\frac{6}{8}$ rays."—*Le Sueur.*

† *M. lachrymale* is said to resemble the common Red Horse. The cranium, with oblique superopercular region and elevated vertex, with a ridge on each side as in *M. macrolepidotum.* Premaxillary spines forming a distinct projecting nose; mouth inferior, but large, the lips large and thick. Eye small, 2 in interorbital space. Back gently arched. Depth $3\frac{3}{4}$ in length. D. 12 or 13. Olivaceous, scales pale or smoky at base; lower fins white. Neuse River. (Cope.) It is probably identical with *M. macrolepidotum.*

" Form more compressed than in the preceding species, (*forsterianus*). Profile oblong, having the greatest height (which is about ¼ of the total length, including the caudal) at the beginning of the dorsal. The head is smaller than in either of the preceding species, forming scarcely $\frac{1}{6}$ of the total length. The very small mouth is farther back than in *C. hudsonius*, being, when the jaws are retracted, an inch behind the tip of the rather narrow snout, and just even with it when they are protruded. The lips, instead of being papillated, are furrowed vertically in a very regular and beautiful manner. The palate and gullet resemble the same parts in *C. hudsonius*, but are smaller, the comminuting apparatus being more delicate, and the œsophagus remarkably contracted at its origin.

" Fins. Br. 3–3. P. 16. D. 14. V. 9 or 10. A. 9. C. 18 $\frac{3}{3}$.

" The dorsal fin is larger than in the foregoing 2 species, and is nearly in the middle of the fish. The pectorals measure rather less than $\frac{1}{5}$ of the distance between the gill openings and caudal fin. The ventrals are under the middle of the dorsal. The tip of the anal, when turned back, rather overlaps the base of the caudal; its last ray is very small, and its first one short and applied to the base of the second. The caudal is more forked than in the preceding species. The rays of all the fins are thick, particularly those of the anal.

" Intestines: Lining of the abdomen white. There is no distinction between the stomach and rest of the gut. The alimentary canal makes 4 convolutions between the gullet and anus, and bears a proportion to the total length of the fish, excluding the caudal, of 41 to 16. The lining of the intestines has the same minute longitudinal rugæ as that of the preceding 2 species. The air bladder is divided into 3 portions, the central one being the largest, and communicating with the œsophagus. The upper one alone has a thick shining capsule.

" This handsome species was observed by us only in Pine Island Lake, lat. 54°, long. 110°; but it is not unknown in other parts of the fur countries, though much more rare than the 2 preceding species."

Elsewhere (p. 303), Richardson gives measurements of a specimen from Albany River. From these we take the following, reducing the dimensions to proportions of the length: Total length 19½ inches. Head 5½ in length; eye 4¼ in head; caudal lobes 1¼ times length of head; caudal fork 1¾ in head. Height of dorsal equal to length of head. (Named for Charles A. Le Sueur, artist and naturalist, the first to study the fishes of the Great Lakes and author of the first review of the *Catostomidæ*.)

*Catostomus lesueurii*, RICHARDSON, Franklin's Journal, 1823, 772, Pine Island Lake, British America.

*Cyprinus* (*Catostomus*) *sueurii*, RICHARDSON, Fauna Bor. Am., III, 1836, 119, 303.

### 319. MOXOSTOMA BREVICEPS, (Cope).

Form of a *Coregonus*, with deep compressed body, small head and sharply conic snout, which overhangs the very small mouth. Caudal fin with the upper lobe falcate, much longer than the lower, at least in the adult, the lobes similarly colored. Dorsal fin short and high, falcate, the anterior rays 1⅓ to 1½ times base of fin, the free border much concave. Depth 3½ in length. Head 5 to 5¼ in length. Eye small, 5 in head. D. 12 or 13; anal long falcate, reaching beyond front of caudal. Scales 6–45–5. Lower fins bright red. Ohio Valley and Great Lake region, abundant in Lake Erie; our specimens from Toledo, Sandusky, and Cincinnati. This may prove identical with *M. lesueuri*, but the species of the far north has never been critically examined. (*brevis*, short; *-ceps*, head.)

*Ptychostomus breviceps*, Cope, Proc. Am. Phil. Soc. Phila., 1870, 478, Youghiogheny River, Pennsylvania.
*Moxostoma anisurum*, Jordan & Gilbert, Synopsis, 141, 1883, not of Rafinesque.
*Moxostoma crassilabre*, Jordan, Man. Vert., Ed. v., 48, 1890, not of Cope.
*Cotostomus aureolus*, De Kay, and probably of Cope also, not of Le Sueur.

### 320. MOXOSTOMA CONUS, (Cope).

Body flattish, the dorsal outline elevated, the form like that of *M. coregonus*. Head small and conic; mouth exceedingly small, the snout far overpassing it, the muzzle being much longer than in *M. aureolum*. Dorsal rays 14, the fin high, its free border concave. Caudal deeply forked, the upper lobe the longer. Eye large. Coloration smoky above, some scales dusky at their bases; sides pale; lower fins white. Neuse and Yadkin rivers, North Carolina. Perhaps inseparable from *M. breviceps*. (*conus*, cone, from the form of the snout.)

*Ptychostomus conus*, Cope, Proc. Am. Phil. Soc. Phila., 1870, 478, Yadkin River, North Carolina.
*Moxostoma conus*, Jordan, Bull. U. S. Nat. Mus. xii, 126, 1878; Jordan & Gilbert, Synopsis, 141, 1883.

### 321. MOXOSTOMA PŒCILURUM, (Jordan).

Body elongate, moderately compressed, somewhat elevated forward. Depth 4⅓ in length; head 4⅓. Mouth medium, the lips full. Dorsal rays 13. Scales large, 5–44–4. Coloration usual, except that caudal fin is red, the lower lobe jet black, the lower margin abruptly white; other fins all red, with blackish shadings. Size small. Southern Mississippi to Eastern Texas (Pearl, Tangipahoa, and Sabine rivers); not rare in sandy streams of the pine woods. (ποικίλος, variegated; οὐρά tail.)

*Myxostoma pœcilura*, Jordan, Bull. U. S. Nat. Mus., x, 66, 1877, Tangipahoa River, Louisiana. (Type, No. 21096.)
*Moxostoma pœcilurum*, Jordan, Bull. U. S. Nat. Mus., xii, 129, 1878; Jordan & Gilbert, Synopsis, 141, 1883.

### 322. MOXOSTOMA RUPISCARTES, Jordan & Jenkins.

(Jump-rocks.)

Body long and low, subterete; head very short, broad, flat above; snout bluntish, projecting beyond mouth, 2⅓ in head; eye moderate, 4½ in head. Lips full, the folds somewhat broken into papillæ. Scales smaller than in related species, 6–50–6, 18 before dorsal. Dorsal low and small, its free edge concave, its first ray 1½ in head. Caudal short, lunate, its lobes bluntish and equal, pectorals long, ventrals short. Dark olive brown, gradually paler below, young with pale streaks along the rows of scales; a faint dark spot above pectoral; tips of dorsal and caudal more or less dusky. Head $4\frac{4}{5}$; depth $5\frac{1}{2}$ to 6. D. 11; A. 8. L. 12 inches. Rivers of Carolina and Georgia from the Catawba to the Chattahoochee; abundant about rocks and rapids, representing the next species from the Catawba southward. (*rupiscartes*, *rupis*, rock; *σκάρτης*, jumper, a word used by Swainson for a blenny which jumps on rocks like a lizard.)

*Moxostoma rupiscartes*, Jordan & Jenkins, Proc. U. S. Nat. Mus., 1888, 353, Catawba River, at Morganton, N. C.; Buck's Creek, at Pleasant Garden, N. C.; Pacollet River, at Clifton, S. C.; Tiger River, near Spartanburg, S. C.; Saluda River; Chattahoochee River; Ocmulgee River. (Type, No. 39927.)

### 323. MOXOSTOMA CERVINUM, (Cope).

(Jumping Mullet.)

Head very short, roundish above, rather pointed forward, about 5 in length. Cheeks subvertical, their depth less than $\frac{1}{2}$ the distance from snout to preopercle. Mouth rather large, with thick lips, which are strongly plicate, the folds somewhat broken up. Eye small. Fins very small; the dorsal rays 10 to 12; free edge of dorsal straight, its longest ray less than head. Scales rather large, 6–43–5, 13 before dorsal. Color greenish brown; a pale blotch on each scale, these forming continuous streaks along the rows of scales, back with more or less distinct brownish cross blotches; fins brownish, not much red, the dorsal and caudal inky black at tip. Size smallest in the genus, length 8 to 10 inches. Rivers of the South Atlantic States from the James to the Neuse, abundant in rapids and pools among rocks. (*cervinus*, fawn color.)

*Teretulus cervinus*, Cope, Jour. Ac. Nat. Sci. Phila., 1868, 236, headwaters of Roanoke and James rivers, Virginia. (Type, No, 14994.)

*Ptychostomus cervinus*, Cope, Proc. Am. Phil. Soc. Phila., 1870, 478.

*Moxostoma cervinum*, Jordan, Bull. U. S. Nat. Mus., XII, 129, 1878; Jordan & Gilbert, Synopsis, 142, 1883, where specimens of *M. rupiscartes* are included with it.

## 98. PLACOPHARYNX, Cope.

*Placopharynx*, Cope, Proc. Am. Phil. Soc. Phila., 1870, 467, (*carinatus*).

Suckers like *Moxostoma* in all respects, except that the pharyngeal bones are much more developed and the teeth reduced in number, those on the lower half of the bone very large, 6 to 10 in number, nearly cylindric in form, being but little compressed and with a broad, rounded, or flattened grinding surface.* Mouth larger and more oblique than usual in *Moxostoma*, the lips thicker. Size large. (*πλάξ*, a broad surface; *φάρυγξ*, pharynx.)

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*The forms and position of these enlarged teeth vary considerably; in a specimen before us the first tooth is the highest and most compressed, its summit being rounded and then abruptly truncate; the second tooth is notably shorter and thicker, much larger, and rounded on top, the body of the tooth serving as a peduncle for the swollen grinding surface; the third tooth is still shorter and similar in form; the fourth tooth is similar to the first, being much higher than the second and third, and flat on top; the others seem to be irregularly alternated or arranged in pairs, a long one and a short one, the long teeth in all cases being the most truncated, as if their surfaces had been most worn off.

### 324. PLACOPHARYNX DUQUESNII, (Le Sueur).

Head 4; depth 3⅘. Scales 6–45–6. Dorsal rays 12 or 13; ventral 9. Body oblong, moderately compressed, heavy at the shoulders. Head large, broad, and flattish above, its upper surface somewhat uneven. Eye small, behind the middle of the head. Mouth large, the lower jaw oblique when the mouth is closed, the mouth, therefore, protractile forward as well as downward. Lips very thick, coarsely plicate, the lower lip full and heavy, truncate behind. Free edge of dorsal concave, the longest ray longer than base of fin, 1⅕ in head; upper lobe of caudal narrower than lower and somewhat longer. Color dark olive green, the sides brassy, not silvery; lower fins and caudal orange red. L. 30 inches. Michigan (Detroit) to Tennessee, Georgia, and Arkansas; abundant in the larger streams, especially in the French Broad and in the Ozark region. (Named for Fort Duquesne, now Pittsburg.)

*Catostomus duquesnii*,* LE SUEUR, Jour. Ac. Nat. Sci. Phila., I, 1817, 105, Ohio River at Pittsburg, Pennsylvania.

*Placopharynx carinatus*, COPE, Proc. Am. Phil. Soc. Phila., 1870, 467, Wabash River.

*Placopharynx carinatus*, JORDAN, Bull. U. S. Nat. Mus., XII, 108, 1878.

*Placopharynx carinatus*, JORDAN & GILBERT, Synopsis, 142, 1883.

## 99. LAGOCHILA,† Jordan & Brayton.

(RABBIT-MOUTH SUCKER.)

*Lagochila*, JORDAN & BRAYTON, Proc. Ac. Nat. Sci. Phila., 1877, 280, (*lacera*); name similar to *Lagocheilus*, a genus of mollusks.

*Quassilabia*, JORDAN & BRAYTON, Man. Vert. E. U. S., Ed. 2, 1878, 401, (*lacera*); substitute for *Lagochila*, regarded as preoccupied.

Suckers like *Moxostoma* in every respect excepting the structure of the mouth. Head shortish, conical, with lengthened snout; the opercular region short, so that the eye is well backward. Suborbital bones narrow. Fontanelle large, widely open. Mouth large, singular in structure, inferior, the upper lip not protractile, greatly prolonged, closely plicate; lower lip much reduced, divided into 2 distinct elongate lobes, which are weakly papillose; the split between these lobes extends backward to the edge of the dentary bones, which are provided with a rather hard, horny plate; the lower lip is entirely separated from the upper at the angles by a deep fissure; the skin of the cheeks forms a sort of cloak over this fissure, the crease separating this skin from the mouth extending up on the sides of the muzzle; the crease between the lips extends down on the under side of the head. System of muciferous tubes well developed. Pharyngeal bones about as in *Moxostoma*, rather weak, with numerous small teeth. Body elongate, not much compressed, not elevated. Fins moderate, formed as in *Moxostoma*. Scales large, as in *Moxostoma*, the lateral line well developed and nearly straight, with about 45 scales in its course. Air bladder in 3 parts. Sexual peculiarities little marked. (*λαγώχειλος*, hare-lipped.)

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* *C. Duquesnii.*—"Head large and long; mouth wide; scales large, subtrilobate; dorsal fin quadrangular; the anal fin extends as far as the base of the caudal fin, which is greatly forked; lateral line arched at the center of the body. Body long, a little compressed; snout strong; the mouth is furnished with thick, plicated, and very large lips; pectoral fins pretty large; the scales are strong, greatly radiated, and as wide again as long—they are of nearly an equal size on the whole body; the lateral line forms a long curvature toward the back; lobes of the caudal fin pointed, the upper lobe somewhat the largest; length from the snout to the extremity of the caudal fin 19 inches; depth 3½ inches; thickness 2 inches; the head measures about ⅛ part of the whole fish. P. 17. D. 14. V. 10. A. 9. C. 18¾ rays. This new species is so strongly marked that it will be easily distinguished from the foregoing. It inhabits the Ohio, and was discovered at Pittsburg, the ancient Fort Duquesne, by Mr. Thomas Say."—*Le Sueur.*

The name *duquesnii* has been usually applied to the common red horse, but the description applies much better to the species of *Placopharynx.*

† By the rules of the American Ornithologists' Union, *Quassilabia* would be preferred to *Lagochila*, on account of the similarity of the latter to *Lagocheilus.* As the two words are spelled differently, we regard them as distinct.

### 325. LAGOCHILA LACERA, Jordan & Brayton.

(Hare-lip Sucker; Cut-lips; Split-mouth Sucker; May Sucker; Rabbit-mouth Sucker; Pea-lip Sucker.)

Head short, conical, with lengthened snout, the region between the eyes flattened and with prominent mucous ridges. Cheeks and lower part of head rather swollen. Opercle much reduced, its greatest length scarcely greater than the diameter of the eye. Head about 4⅔ in length. Eye 4⅓ in length of head, about 2 in length of the snout, its situation thus quite posterior. Length of the top of the head 2⅔ in the distance from the snout to the base of the dorsal. Body rather slender, the form much as in *Moxostoma cervinum*, the depth 4⅔ in the length. Dorsal fin rather low, its rays 12. A. 7; V. 9. Scales 5–45–5. Color olive or bluish, brown above; sides and belly silvery; lower fins faintly orange. Clear streams of the Mississippi Valley, abundant only in the Ozark Mountains, thus far known from the Scioto, Wabash, Clinch, Cumberland and Chickamauga rivers, and the White River of Arkansas. (*lacer*, torn.)

*Lagochila lacera*, Jordan & Brayton, Proc. Ac. Nat. Sci. Phila., 1877, 280, Chickamauga River, Ringgold, Georgia. (Type, No. 31129. Coll. Jordan & Brayton.)
*Quassilabia lacera*, Jordan, Man. Vert., Ed. 2, 406, 1878; Jordan & Gilbert, Synopsis, 144, 1883.

### Supplemental Note on Catostomidæ.

*Chasmistes brevirostris*, Cope, should apparently be transferred to the genus *Catostomus*, standing next to *Catostomus fecundus*, Cope and Yarrow. The two seem to constitute a distinct section, or subgenus (*Lipomyzon*, Cope), intermediate between *Catostomus* and *Chasmistes*.

## Family XXXVII. CYPRINIDÆ.

### (The Carps.)

Cyprinoid fishes with the margin of the upper jaw formed by the premaxillaries alone and the lower pharyngeal bones well developed, falciform, nearly parallel with the gill arches, each provided with 1 to 3 series of teeth in small number, 4 to 7 in the main row, and a less number in the others, if more are present. Head naked; body scaly (except in *Meda* and *Plagopterus*, of North America, *Phoxinellus* and *Aulopyge*, of Europe, and a few others). Barbels 2 or 4; absent in most of our genera, and not large in any. Belly usually rounded, rarely compressed, never serrated. Gill openings moderate, the membranes broadly joined to the isthmus. Branchiostegals always 3. Gills 4, a slit behind the fourth. Pseudobranchiæ usually present. No adipose fin. Dorsal fin short in all the American species, elongate in many Old World forms. Ventral fins abdominal. Air bladder usually large, commonly divided into an anterior and a posterior lobe, not inclosed in a bony capsule, rarely wanting. Stomach without appendages, appearing as a simple enlargement of the intestines. Fishes mostly of moderate or small size, inhabiting the fresh waters of the Old World and of North America. Genera about 200; species nearly 1,000; excessively abundant where found, both in individuals and species, and, from their great uniformity in size, form, and coloration, constituting one of the most difficult groups in natural history in which to distinguish genera and species. Our genera are mostly very closely related, and are separated by characters which, although reasonably constant, are often of slight structural importance. The spring, or breeding dress, of the male fishes is often peculiar. The top of the head, and often the fins or various portions of the body, are covered with small tubercles, outgrowths from the epidermis. The fins and lower parts of the body in the spring males are often charged with bright pigment, the prevailing color of which is red, although in some genera it is satin-white, yellowish, or black.

It is not easy to arrange the genera of *Cyprinidæ* in accordance with possible lines of descent. The herbivorous species with straight teeth in one series (as *Orthodon*), are doubtless nearest the primitive type, which has degenerated into weak forms like *Hybognathus*. In like manner *Notropis* seems to have degenerated from *Leuciscus*, and perhaps *Hybopsis* from *Gobio*. Such forms as *Mylocheilus* and *Ptychocheilus* doubtless approach the original line of descent. The Old World *Cyprinidæ* are at once more primitive and more highly organized than American forms. The Pacific Coast species approach the European types. (CYPRINIDÆ, part, Günther, Cat., VII, 25–339.)

NOTE.—Young *Cyprinidæ* are usually more slender than adults of the same species, and the eye is always much larger; they also frequently show a black lateral stripe and caudal spot, which the adults may not possess. In the following descriptions the rudimentary rays of dorsal and anal are not counted. The fins and scales are often, especially in specimens living in small brooks, covered with round black specks, immature trematodes. These should not be mistaken for true color markings.

No progress can be made in the study of these fishes without careful attention to the teeth, as the genera are largely based on dental characters. The pharyngeal bones in the smaller species can be removed by inserting a pin (or, better, a small hook) through the gill opening, under the shoulder girdle. The teeth should be carefully cleaned with a toothbrush, or, better, a jet of water, and when dry may be examined by any small lens. In most cases a principal row of 4 or 5 larger teeth will be found, in front of which is a set of 1 or 2 smaller ones. The two sides are usually, but not always, symmetrical. Thus, "teeth 2, 4–5, 1," indicates two rows of teeth on each side, on the one side 4 in the principal row and 2 in the lesser; on the other side 5 in the main row and 1 in the other. "Teeth 4–4" indicates a single row of 4 on each pharyngeal bone, and so on.

In the *Leuciscine* genera, these teeth, or the principal ones, are "raptatorial," that is, hooked inward at the tips. A grinding or masticatory surface is an excavated space or groove, usually at the base of the hook. Sometimes the grinding surface is very narrow and confined to one or two teeth. Sometimes a beveled or flattened edge looks so much like a grinding surface as to mislead a superficial observer. In some cases the edge of the tooth is crenate or serrate.

Besides the native species here mentioned, representatives of several other genera have been introduced from Europe, and two of these have become common inhabitants of many streams, east and west. These are *Cyprinus**, Linnæus, and *Carassius*, Nilsson. The first is distinguished by the very long dorsal, which, like the anal, is preceded by a strong spine serrated behind. About the mouth are 4 long barbels, and the teeth are molar, 1, 3–3, 1. This genus is represented by the carp (*Cyprinus carpio*, L.). The carp is normally covered with large scales. In domestication, however, variations have arisen, prominent ones being the "Leather Carp," naked, and the "Mirror Carp," with a few series of very large scales.

*Carassius*, Nilsson, differs from *Cyprinus* chiefly in the absence of barbels and in having the teeth compressed, 4–4. The goldfish (*Carassius auratus*, Linnæus), is originally olivaceous, but only the orange-red variety is valued for aquaria. Both *Carassius* and *Cyprinus* are native in China.

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**Cyprininæ*. Dorsal fin elongate; dorsal and anal fins each preceded by a serrated spine; teeth molar. Species introduced from Europe and Asia.

*a.* Barbels 4; teeth 1, 1, 3–3, 1, 1. CYPRINUS.

*aa.* Barbels none; teeth 4–4. CARASSIUS.

### CYPRINUS (Artedi) Linnæus. THE CARPS.

*Cyprinus*, (Artedi), LINNÆUS, Syst. Nat., Ed. x, 1758, 320, (*carpio*).

Body robust, compressed, resembling that of the buffalo-fish. Mouth moderate, anterior, with 4 long barbels. Snout blunt, rounded. Teeth molar, broad and truncate, 1, 1, 3–3, 1, 1. Scales large. Lateral line continuous. Dorsal fin very long, with a stout spine, serrated behind; anal fin short, also with a spine. Large fishes of the fresh waters of Asia; introduced into Europe and America as food-fishes. It has been generally introduced into private ponds in nearly all parts of the United States; from there it has escaped into the streams and lakes, and is now an abundant fish in most of our larger, warmer rivers and in the ponds and bayous of the Mississippi Valley. On the south shore of Lake Erie it has become well established and is of considerable commercial importance. (κυπρτνος, the ancient name of the carp.)

### CYPRINUS CARPIO, Linnæus. CARP.

Dorsal III, 20; A. III, 5; scales 5–38–5; teeth 1, 1, 3–3, 1, 1. Body stout, more or less compressed, heavy anteriorly. L. 18 inches or more. Fresh waters of Central Asia; introduced as a food-fish into Europe and America. In domestication it has run into many varieties, distinguished by differences in form, squamation, and development of fins. (*Carpio*, carp.)

*Cyprinus carpio*, LINNÆUS, Syst. Nat., Ed. x, 1758, 320; GÜNTHER, Cat., VII, 25.

### CARASSIUS, Nilsson. THE CRUCIAN CARPS.

*Carassius*, NILSSON, Prodromus, Ichthy. Scand., 1832, (*carassius*).

Body oblong, compressed, and elevated. Mouth terminal, without barbels. Teeth 4–4, molar, but compressed. Scales large. Lateral line continuous. Dorsal fins very long, with the third ray developed into a stout spine, which is serrated behind; anal short with a similar spine. Ventrals well forward. Large species of the fresh waters of Europe and Asia; often domesticated. (*Carassius*, a Latinization of the vernacular names Karass or Karausche, applied to the European Crucian carp, *C. carassius*.)

### CARASSIUS AURATUS (Linnæus). GOLDFISH.

D. II, 18; A. II, 7; Lat. 1, 26; teeth, 4–4. Body stout, covered with large scales. Dorsal and anal fins with the spines strong, coarsely serrated. Coloration olivaceous, usually orange, or variegated in domestication. Length, 12 inches. China and Japan; introduced everywhere as an aquarium fish, and now naturalized in many of our eastern streams. The variations are innumerable. (*auratus*, gilded.)

*Cyprinus auratus*, LINNÆUS, Syst. Nat., Ed. x, 1758, 323.
*Carassius auratus*, GÜNTHER, Cat., VII, 32.

Other European species, as the Tench (*Tinca tinca* (Linnæus)) and the Ide (*Idus idus* (Linnæus)), have been introduced into America, but none of these are yet well established anywhere.

*A.* Dorsal fin short, without developed spine; no anal spine.

Campostominæ:

- *a.* Air bladder surrounded by many convolutions of the very long alimentary canal; herbivorous.
  - *b.* Teeth 4–4, or 1, 4–4, 0, with oblique grinding surface and slight hook; peritoneum black. Campostoma, 100.
- *aa.* Air bladder above the alimentary canal, as usual in fishes.

  Chondrostominæ.*
  - *c.* Intestinal canal elongate, usually more than twice the length of the body; teeth 1-rowed, with grinding surface well developed; peritoneum usually black; herbivorous.
    - *d.* Teeth 6–6, strongly compressed, knife-shaped; pseudobranchiæ none; rudimentary caudal rays greatly developed; scales very small. Orthodon, 101.
    - *dd.* Teeth 5–5 or 4–5; dorsal fin inserted posteriorly; scales small.
      - *e.* Pseudobranchiæ none; lower jaw thin, with hard, sharp edge; upper jaw protractile, with fleshy covering; body elongate, subterete. Oxygeneum, 102.
      - *ee.* Pseudobranchiæ present.
        - *f.* Jaws each with a conspicuous, broad, straight-edged, horny plate; teeth 4–5, stout, bluntish, hooked, and short. Acrocheilus, 103.
        - *ff.* Jaws without horny plate.
          - *g.* Lateral line complete; rudimentary caudal rays numerous; anal basis elongate. Lavinia, 104.
          - *gg.* Lateral line incomplete; anal basis short; scales minute. Chrosomus, 105.
    - *ddd.* Teeth 4–4; dorsal fin nearly median; jaws without horny plate.
      - *h.* First (rudimentary) ray of dorsal slender, firmly attached to the first developed ray, as usual among fishes.
        - *i.* Scales very small, 55 to 72 in the lateral line, which is complete. Algansea, 106.
        - *ii.* Scales larger, 35 to 45 in the lateral line. Hybognathus, 107.
      - *hh.* First (rudimentary) ray of dorsal somewhat enlarged and blunt, connected by membrane with the first developed ray. Pimephales, 108.
  - *cc.* Intestinal canal short, less than twice the length of the body; peritoneum usually pale; teeth 1 or 2-rowed; carnivorous or partly so.

    Mylopharodontinæ:
    - *j.* Teeth scarcely hooked, some or all of them molar, blunt, or stump-shaped, much enlarged and obtusely truncate; large, coarse fishes.
      - *k.* Teeth 2, 4–5 or 5–5, 2.
        - *l.* Upper jaw not protractile; no barbels. Mylopharodon, 109.
        - *ll.* Upper jaw protractile; maxillary with a barbel. Mylocheilus, 110.
      - *kk.* Teeth 3–3; upper jaw protractile. Stypodon, 111.
    - *jj.* Teeth hooked, slender, none of them molar, the grinding surface, if present, narrow or rudimentary.

      Leuciscinæ:
      - *m.* Lower jaw normally formed, the dentary bones curved, free from each other, except at the symphysis.
        - *n.* Teeth in the main row, 5–5 or 4–5.
          - *o.* Abdomen behind ventral fins transversely rounded, the scales passing over it; the edge not forming a scaleless ridge; anal base generally, but not always, short.
            - *p.* Maxillary with a barbel; premaxillaries protractile.
              - *q.* Barbel minute, not quite terminal; teeth without grinding surface; caudal fin symmetrical, its rudimentary basal rays not greatly developed. Semotilus, 112.

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*This subfamily, as here recognized, is extremely heterogeneous. Some of the American genera of herbivorous minnows and chubs, as *Orthodon*, *Acrocheilus*, and perhaps *Oxygeneum* and *Lavinia*, are allied to the European *Chondrostoma*. The others may be descended from Leuciscine types, or they may have degenerated from other herbivorous forms.

*qq.* Barbel terminal; teeth with grinding surface; caudal fin unsymmetrical; the upper lobe much the longer in the adult, the basal caudal rays greatly developed. POGONICHTHYS, 113.

*pp.* Maxillary without barbel.

*r.* Teeth 2-rowed; usually 2 teeth in the lesser row.

*s.* Teeth subconical, scarcely hooked, sharp-edged, wide apart, the long limb of the pharyngeal bone elongate; body elongate; mouth large; lateral line complete. PTYCHOCHEILUS, 114.

*ss.* Teeth compressed, close-set, strongly hooked; the pharyngeal bone of the usual form.

*t.* Caudal peduncle slender and elongate, the caudal fin widely forked, its basal rudiments much developed; scales very small; head depressed in the adult. GILA, 115.

*tt.* Caudal peduncle stout; basal rudiments of caudal little developed. LEUCISCUS, 116.

*rr.* Teeth 1-rowed, 4–5 or 5–5.

*u.* Mouth of moderate size; teeth entire.

*v.* Gill rakers short and small; body not much compressed; anal fin short in American species. RUTILUS, 117.

*vv.* Gill rakers slender; body much compressed; anal fin rather long. LUXILINUS, 118.

*uu.* Mouth extremely small; teeth serrate. OPSOPŒODUS, 119.

*oo.* Abdomen behind ventral fins compressed to a sharp edge over which the scales do not pass; abdomen in front of ventrals, rounded; anal basis elongate; dorsal posterior; teeth 5–5, serrate or entire. ABRAMIS, 120.

*nn.* Teeth in the main row, 4–4, the lesser row often absent; anal basis usually short.

*w.* Maxillary without barbels.

*x.* Upper jaw distinctly protractile.

*y.* Scales comparatively large, 30 to 60 in lateral line.

*z.* Jaws each with a hardened bony sheath; first ray of dorsal spine like, connected by membrane with the first developed ray; teeth 4–4. COCHLOGNATHUS, 121.

*zz.* Jaws without bony sheath.

*a′.* Lower jaw with the lip thin or obsolete, not developed as a fleshy lobe on each side at base; scales large, 30 to 50.

*b′.* Mandible, interopercle, and subopercle not cavernous.

*c′.* First (rudimentary) ray of dorsal simple, detached from the first developed ray, to which it is connected by membrane (precisely as in *Pimephales* and *Cochlognathus*); a conspicuous black spot on front of dorsal and on base of caudal. CLIOLA, 122.

*cc′.* First simple ray of dorsal rudimentary and closely adnate to the first branched ray (as usual in the family). NOTROPIS, 123.

*bb′.* Mandible, interopercle, and suborbital with conspicuous, externally visible, cavernous chambers; teeth 1, 4–4, 0; scales large. ERICYMBA, 124.

*aa'*. Lower jaw with the lip developed as a fleshy lobe on each side; teeth 4–4; dorsal anterior; scales rather small, 40 to 60. PHENACOBIUS, 125.

*yy*. Scales very small, 85 to 90 in lateral line; body long and low, subterete; mouth small, the upper jaw little protractile; teeth 4–4. EVARRA, 126.

*xx*. Upper jaw not protractile; lips fleshy; body elongate, covered with minute scales; teeth small, 1, 4–4, 1. TIAROGA, 127.

*ww*. Maxillary with a small barbel at or near its extremity.

*d'*. Premaxillaries not protractile; the frenum very broad; teeth 2, 4–4, 2; scales small, dorsal posterior. RHINICHTHYS, 128.

*dd'*. Premaxillaries protractile (rarely joined to the forehead by a narrow frenum).

*e'*. Scales very small, 60 to 90 in lateral line; lateral line often incomplete; dorsal posterior. AGOSIA, 129.

*ee'*. Scales large, 35 to 55; dorsal median; lateral line complete.

*f'*. Teeth 4–4, or 1, 4–4, 1 or 0, the lesser row with never more than 1. HYBOPSIS, 130.

*ff'*. Teeth usually 2, 4–4, 2, the lesser row rarely with less than 2.

*g'*. Head convex above; teeth without grinding surface; barbel not quite terminal. COUESIUS, 131.

*gg'*. Head more or less flattened above; teeth with grinding surface; barbel terminal. PLATYGOBIO, 132.

EXOGLOSSINÆ:

*mm*. Lower jaw singularly formed, the dentary bones parallel, united for their whole length.

*h'*. Premaxillaries not protractile; mandible with a conspicuous fleshy lobe on each side at the base; teeth 1, 4–4, 0 or 1; no barbel; scales moderate. EXOGLOSSUM, 133.

PLAGOPTERINÆ:

*AA*. Dorsal fin short, posterior, with a strong spine, composed of 2, the posterior received into a longitudinal groove of the anterior; inner border of the ventral fins adherent to the body; teeth hooked, without grinding surface, in 2 rows.

*i'*. Body with small scales; teeth 2, 4–4, 2; no barbels. LEPIDOMEDA, 134.

*ii'*. Body scaleless; teeth 2, 4–5, 2.

*j'*. Maxillary without barbel. MEDA, 135.

*jj'*. Maxillary with a barbel. PLAGOPTERUS, 136.

## 100. CAMPOSTOMA, Agassiz.

### (STONE ROLLERS.)

*Campostoma*, AGASSIZ, Amer. Journ. Sci. Arts, 1855, 218, (*anomalum*).

Body moderately elongate, little compressed. Mouth normal, the jaws with thick lips and rudiment of a hard sheath. Premaxillaries protractile; no barbel. Teeth 4–4, or 1, 4–4, 0, with oblique grinding surface, and a slight hook on 1 or 2 teeth. Air bladder suspended in the abdominal cavity, and entirely surrounded by many convolutions of the long alimentary canal, which is 6 to 9 times the total length of the body; ovaries similarly inclosed by the alimentary canal. Peritoneum black. Pseudobranchiæ present. Scales moderate. Lateral line present. Dorsal nearly over ventrals. Anal short. No spines. Herbivorous. Sexual differences very great, the males being covered with large tubercles in spring. The singular arrangement of the intestines in relation to the air bladder is peculiar to *Campostoma* among all known fishes. Size moderate. (καμπή, curve; στόμα, mouth)

*a.* Scales in lateral line about 73.
  *b.* Length of top of head ⅖ distance to origin of dorsal fin; mouth rather large, maxillary not quite reaching the eye. ORNATUM, 326.
  *bb.* Length of top of head ½ distance to origin of dorsal fin; mouth smaller, maxillary reaching vertical from anterior nostril. PRICEI, 327.
*aa.* Scales in lateral line 49 to 55. ANOMALUM, 328.
*aaa.* Scales larger, 45 to 47 in lateral line. FORMOSULUM, 329.

### 326. CAMPOSTOMA ORNATUM, Girard.

Head 3¾; depth 4; eye 4. D. 8; A. 8; lateral line 72; 41 before dorsal. Body rather stout; head moderate, the snout projecting and somewhat acute; mouth small, the maxillary not reaching to front of eye. Coloration of male, brilliant, precisely as in *C. anomalum*, the scales of back mottled. Like *C. anomalum* in all respects except the much smaller scales. Chihuahua River, Mexico. Our specimens obtained recently by A. J. Woolman. (*ornatus*, adorned.)

*Campostoma ornatum*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 176, Chihuahua River, Mexico. (Type, No. 77. Coll. J. Potts.) GÜNTHER, Cat., VII, 183, 1868; JORDAN & GILBERT, Synopsis, 149, 1883.

### 327. CAMPOSTOMA PRICEI, Jordan & Thoburn, new species.

Head 3½ in adult male; depth 4; eye 5½; D. 8; A. 8; scales 10–75–9, 32 before dorsal; teeth 4–4. Body stout, moderately compressed; head large, conical, with large tubercles, each with a central spine; mouth small, maxillary reaching vertical from anterior nostril, ⅔ distance to eye, or 3⅓ in head. Dorsal fin opposite ventrals, its first ray ½ distance from snout to base of caudal; anal basis short, 3 in head. Length of top of head nearly half distance from tip of snout to origin of dorsal (⅖ in *ornatum*). Scales rather small, deep, somewhat crowded anteriorly. Color as in *C. anomalum*; brownish, with brassy luster on back and sides; scales above profusely speckled with black, the color arranged in longitudinal bands, quite evident back of the dorsal; less black below; a vertical black band behind opercle; a distinct black spot at base of caudal; a broad band of black across dorsal fin, and traces of a similar band on anal; fins all flushed with red (in spring males). Very close to *C. ornatum* of the Chihuahua River; the head longer, the snout longer, and the mouth and eye smaller. Springs in the Chiricahua Mountains in Southern Arizona, tributary to the Rio Yaqui, locally very abundant. The waters of these springs are lost on the desert, very rarely overflowing into the river. The type a single specimen, 3½ inches long, taken by Mr. W. W. Price, in Rucker Cañon, Chiricahua Mountains, in southern Arizona. (Named for William Wightman Price.) (Type, No. 1552, L. S. Jr. Univ. Mus.)

### 328. CAMPOSTOMA ANOMALUM (Rafinesque).

(STONE-ROLLER; STONE-LUGGER; STEEL-BACKED CHUB; MAMMY; DOUGH-BELLY.)

Head 4⅕; depth 4⅖. D. 8; A. 7; scales 7–53–8; teeth 4–4, or 1, 4–4, 0. Body stoutish, moderately compressed, the antedorsal region becoming swollen and prominent in the adult. Snout moderately decurved. Scales deep, rather small, and crowded anteriorly; maxillary not reaching to opposite the front of the eye. Color brownish, with a brassy luster above, the scales more or less mottled with dark; a dusky vertical bar behind the opercle; dorsal and anal fins each with a dusky crossbar about half way up, the rest of the fin olivaceous in females, fiery red in the males in the spring; iris orange in males. Males in the spring with the head and often the whole body covered with large rounded tubercles. In no other *Cyprinoid* are these nuptial appendages so extensively developed. Extremely variable, the young very different in appearance from the old males. Length 6 to 8 inches. Central New York to Tennessee, Wyoming, and Texas; everywhere abundant in deep or still places in small streams, running up small brooks to spawn in spring. Herbivorous. One of the most interesting and curious of our fishes. (*anomalus*, extraordinary.)

*Rutilus anomalus*, Rafinesque, Ichth. Oh., 52, 1820, Licking River, Kentucky.
*Catostomus melanotus*, Rafinesque, Ichth. Oh., 58, 1820, Ohio River.
*Exoglossum spinicephalum*, Cuvier & Valenciennes, xvii, 489, 1844, Wabash River.
*Leuciscus prolixus*, Storer, Proc. Bost. Soc. Nat. Hist., July, 1845, Alabama.
*Exoglossum dubium*, Kirtland, Journ. Bost. Soc. Nat. Hist., v, 1845, 272, Yellow Creek, Ohio.
*Chondrostoma pullum*, Agassiz, Amer. Journ. Sci. Arts, 1854, 357, Burlington, Iowa. (Coll. Dr. J. H. Rausch.)
*Campostoma nasutum*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 176, Cadereita, and near Monterey, New Leon. (Type, No. 75. Coll. Lieut. Couch.)
*Campostoma callipteryx*, Cope, Proc. Ac. Nat. Sci. Phila., 1864, 284, Flint River, Michigan. (Coll. Prof. Manly Miles.)
*Campostoma mormyrus*, Cope, *l. c.*, 284, Bruce, Michigan. (Coll. Miles.)
*Campostoma gobionium*, Cope, *l. c.*, 284, Bruce and Grosse Isle, Michigan. (Coll. Miles.)
*Campostoma hippops*, Cope, *l. c.*, 284, Platte River, Nebraska. (Coll. Dr. W. A. Hammond.)
*Campostoma anomalum*, Agassiz, Amer. Journ. Sci. Arts, 1855, 218; Jordan & Gilbert, Synopsis, 149, 1883.
*Campostoma dubium*, Günther, Cat., vii, 183, 1868.
*Campostoma prolixum*, Jordan & Gilbert, Synopsis, 150, 1883; this name applied to southern specimens in which the teeth are usually 1, 4–4, 0.

### 329. CAMPOSTOMA FORMOSULUM, Girard.

Head 4; depth 4½. D. 8; A. 7; scales 46. Head short and blunt, with broad, projecting snout. Grayish above, whitish below; sides more or less marmorate; a black patch at base of caudal fin and one on the dorsal. San Antonio River to the Rio Grande. (*formosulum*, diminutive of *formosus*, pretty.)

*Campostoma formosulum*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 176, Rio Sabinal, near San Antonio, Texas. (Type, No. 76. Coll. Dr. Kennerly.) Girard, U. S. & Mex. Bound. Surv., Zoöl., 41, pl. xxv, figs. 5–8, 1859; Jordan & Gilbert, Synopsis, 150, 1883.

## 101. ORTHODON, Girard.

*Orthodon*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 182, (*microlepidota*).

Body elongate. Jaws normal, the upper protractile, the lower sharp-edged, with a knob at the symphysis; no barbel. Teeth 6–6 or 6–5, much compressed, lancet-shaped, erect, nearly straight. Upper limb of the pharyngeal bone very broad and concave, separated by a deep notch from the dentigerous portion, the bone thin and brittle. Intestinal canal elongate, about 7 times the length of the fish; peritoneum black; scales small; lateral line present. Dorsal fin opposite ventrals. Basal rays of caudal largely developed. Anal basis short. Pseudobranchiæ none. Gill rakers moderate, clavate, the inner edge fringed. Size large. This genus is related to the European genus, *Chondrostoma*, differing chiefly in the absence of pseudobranchiæ and of the horny mandibular plate. (*ὀρθός*, straight; *ὀδούς*, tooth.)

### 330. ORTHODON MICROLEPIDOTUS (Ayres).

(BLACK-FISH.)

Head 4; depth 4½. D. 9; A. 8; scales 21–105–12; Vert. 24+20. Teeth 6–6 or 6–5, very long. Body elongate, not much compressed. Head moderate, flattish above, with two bony ridges; snout very broad; eye small, about half length of snout. Mouth terminal, somewhat oblique, broad, the maxillary not extending to the eye. Fins rather large; the caudal strong. Lateral line decurved. Coloration plain olivaceous, paler below. Size large. Length 12 to 16 inches. Lower Sacramento and San Joaquin rivers and neighboring streams; locally abundant in quiet waters. (*μικρολεπιδοτός*, small-scaled.)

*Gila microlepidota*, AYRES, Proc. Cal. Ac. Nat. Sci., I, 21, 1855, Sacramento and San Joaquin rivers, California. (Coll. W. O. Ayres.)

*Orthodon microlepidotus*, GIRARD, Pac. R. R. Surv., Fish., 237, pl, LIII, fig. 1–4, 1858; GÜNTHER, Cat., VII, 275, 1868; JORDAN & GILBERT, Synopsis, 152, 1883.

## 102. OXYGENEUM, Forbes.

*Oxygeneum*, FORBES, Bull. Ill. Lab. Nat. Hist., 1855, 136, (*pulverulentum*).

Body elongate, subterete; head small, conical; mouth large, terminal; upper jaw protractile, with fleshy lips; lower jaw thin, with sharp, hard edge; no pseudobranchiæ; scales rather small; lateral line complete. Alimentary canal elongate, more than twice length of body; teeth 4–5 or 5–5, in one row, not strongly hooked; peritoneum black. Herbivorous species of small size. (*ὀξύς*, sharp; *γένυς*, chin.)

### 331. OXYGENEUM PULVERULENTUM, Forbes.

Head 4⅙; depth 5; eye 4. D. 8; A. 7. Lateral line 63; 31 scales before the dorsal. Form of *Moxostoma;* head small, conical; mouth large, terminal; gill rakers slender. Breast scaly. Dorsal fin high. Color pale, the back and sides dusted with dark specks. Length 2½ inches. Illinois River. (Forbes.) (*pulverulentus*, dusted.)

*Oxygeneum pulverulentum*, FORBES, Bull. Ill. Lab. Nat. Hist., 1885, 136, Illinois River. (Coll. Forbes.) JORDAN, Man. Vertebrates, Ed. v, 52, 1890.

## 103. ACROCHEILUS, Agassiz.

(CHISEL-MOUTHS.)

*Acrocheilus*, AGASSIZ, Amer. Journ. Sci. Arts, 1855, 211, (*alutaceus*).

Body elongate, little compressed. Each jaw with a large, straight, horny plate, sharp externally and very conspicuous. Upper jaw protractile; no barbel. Teeth 4–5, stout, hooked, with broad masticatory surface. Intestinal canal elongate; peritoneum black. Pseudobranchiæ present. Scales small, loosely imbricated. Lateral line present. Dorsal fin slightly behind ventrals. Anal basis moderate. Caudal fin broad, its rudimentary rays recurrent on the caudal peduncle. Size rather large. A single species, American. (*ἄκρος*, sharp; *χεῖλος*, lip.)

### 332. ACROCHEILUS ALUTACEUS, Agassiz & Pickering.

(CHISEL-MOUTH ; SQUARE-MOUTH ; HARD-MOUTH.)

Head 4¼; depth 4; eye 5½. D. 10; A. 9; scales 20–85–16. Teeth 4–5, hooked, somewhat club-shaped, with a broad grinding surface. Body elongate, not much compressed; caudal peduncle very long and slender, nearly terete. Head moderate, bluntish, the profile rounded, the interorbital space strongly convex. Mouth horizontal, subinferior, overlapped by the broad, blunt snout, its breadth considerable, but the maxillary not extending far back, to opposite the front of the eye. Upper jaw protractile, covered with a fleshy lip, inside of which is a small, straight, cartilaginous plate, similar to that on the lower jaw, but much smaller and not evident externally; lower lip covered with a firm cartilaginous plate, sharp externally, the upper surface being formed by its beveled edge. The transverse width of this plate is between 4 and 5 times its (longitudinal) breadth; the plate extends in nearly a straight line from one angle of the mouth to the other; its transverse width is contained 2¾ times in length of head. Eye rather large, 1¾ in snout, its position anterior and not high up, 2¼ in interorbital space. Dorsal long, rather low, its first ray just behind first ray of ventrals, midway between snout and middle of base of caudal; caudal fin very long, the lobes about equal, longer than head, widely forked, the accessory rays at its base very numerous and recurrent on the caudal peduncle; about 8 of these may be distinguished on each side of the fin. Anal fin rather large; ventrals broad, reaching vent. Pectorals moderate, not reaching two-thirds of the distance to the ventrals. Scales quite small, somewhat embedded in the skin, very loosely imbricated, the exposed surfaces longer than high profusely punctate; squamation quite irregular. The scales smaller on back and belly than on sides, most exposed on caudal peduncle. Lateral line much decurved. Coloration very dark; belly paler, but nearly all parts of the body studded with minute dark points. Peritoneum black; intestines much elongate, usually filled with vegetable substance. Length 12 inches. Lower Columbia River and tributaries, as far up as Spokane and Shoshone Falls; locally abundant. (*alutaceus*, leathery.)

*Acrocheilus alutaceus*, AGASSIZ and PICKERING, Amer. Journ. Sci. Arts, XIX, 214, 1855, Willamette Falls and Walla Walla River; GÜNTHER, Cat., VII, 276; JORDAN, Proc. U. S. Nat. Mus., 1878, 83; JORDAN & GILBERT, Synopsis, 150, 1883.

### 104. LAVINIA, Girard.

*Lavinia*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 137, (*exilicauda*).

Body elliptical, elevated, moderately compressed, rapidly contracted to the slender caudal peduncle. Head small, conical. Mouth moderate, terminal, oblique; the lower jaw included. Scales moderate, not closely imbricated, the exposed surfaces somewhat hexagonal. Lateral line decurved, complete. Belly behind ventrals entirely scaled. Dorsal fin well behind ventrals, its last ray just in front of beginning of anal, which is rather elongate. Caudal fin little forked, its rudimentary basal rays much increased in number and very strong. Intestinal canal elongate, 3 times the total length of the fish; peritoneum dark. Teeth 4–5 or

5-5, scarcely hooked, cultriform, with rather broad but shallow grinding surface, the largest standing up well above the surface of the bone. Gill rakers rather long and slender; pseudobranchiæ large. Size large One species. American. (*Lavinia*, a classical name, without special application to these fishes.)

### 333. LAVINIA EXILICAUDA, Baird & Girard.

(HITCH; CHI OR CHIGH.)

Head 4⅔; depth 3⅓; eye 4. D. 10; A. 12; scales 13–64–8; teeth 4–5 or 5–5. Body deep, compressed, tapering to the caudal peduncle, which is very slender. Upper lip on the level of the lower part of the pupil, the maxillary falling short of the eye. Preorbital short and deep; suborbital moderate. Eye rather large, anterior. Scales rather large, 42 in front of dorsal. Dorsal fin rather small; pectorals short; anal high and long; caudal well forked, its rudimentary rays strong, about ten in number. Color dark above, sides somewhat silvery; scales with dark specks. Length 12 inches. Streams of the Coast Range about San Francisco and Monterey, locally common as far north as Clear Lake. (*exilis*, slender; *cauda*, tail.)

*Lavinia exilicauda*, BAIRD and GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 137, Sacramento River, California. (Type, Nos. 207 and 209. Coll. Heermann.) GIRARD, Pac. R. R. Surv., x, 241, 1858. JORDAN & GILBERT, Synopsis, 153, 1883.

*Lavinia harengus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 184, Monterey, California. (Type, No. 210. Coll. A. S Taylor.)

*Leuciscus exilicauda*, GÜNTHER, Cat., VII, 248, 1868.

## 105. CHROSOMUS, Rafinesque.

*Chrosomus*, RAFINESQUE, Ichth. Oh., 47, 1820, (*erythrogaster*).

Body moderately elongate, little compressed. Jaws normal; no barbel; teeth 5-5 or 4–5, moderately hooked, with well-marked grinding surface. Alimentary canal elongate, about twice as long as body; peritoneum black. Scales very small. Lateral line short or wanting. Dorsal behind ventrals; anal basis short. Size small. Colors in spring brilliant, the pigment bright red. This genus is of somewhat doubtful relationship, and shows many analogies with the subgenus *Phoxinus* under *Leuciscus*. (χρώς, color; σῶμα, body.)

*a.* Lower black lateral band extending backward to base of caudal.
  *b.* Lower black band ending in a black spot. ERYTHROGASTER, 334.
  *bb.* Lower black band broader, and not ending in a black spot. DAKOTENSIS, 335.
*aa.* Lower black lateral band extending downward and backward, ending above base of anal, the upper band forming the black caudal spot. OREAS, 336.

### 334. CHROSOMUS ERYTHROGASTER, Rafinesque.

(RED-BELLIED DACE.)

Head 4; depth 4. D. 7; A. 8; scales 16–85–10; teeth usually 5–5. Body oblong, little compressed, tapering each way from the middle. Head moderate, rather pointed. Mouth moderate, terminal, oblique, the jaws about equal. Fins rather small; the dorsal and anal high and short;

caudal long. Scales quite small, firmly attached, but not much imbricated. Lateral line developed less than half the length of the body. Color brownish olive, with a dusky dorsal line and often some blackish spots; two black lateral bands nearly parallel, the one from the upper angle of the opercle straight to the caudal, sometimes broken into spots behind, the lower broader, extending from snout through eye, curved downward along the belly and extending to the caudal, where it ends in a black spot; between these bands a bright, silvery area; belly below the lower band abruptly silvery; females obscurely marked. Males in spring with the belly and the interspace between the lateral bands bright scarlet; bases of the vertical fins also scarlet; in high coloration the body is everywhere minutely tuberculate and the fins are bright yellow. Length 2 to 3 inches. Ohio and Michigan to Iowa and Northern Alabama; also common at Freeport, Maine, (Kendall and Smith.) Abundant in small clear streams; one of the most beautiful of our fishes, especially attractive in aquaria. (*ἐρυθρός*, red; *γαστήρ*, belly.)

*Luxilus* or *Chrosomus erythrogaster*, Rafinesque, Ichth. Oh., 47, 1820, Ohio River.

*Chrosomus pyrrhogaster*, Jordan, Man. Vert., Ed. 1, 284, 1876, White River, Indiana. (Coll. Jordan.)

*Luxilus erythrogaster*, Kirtland, Bost. Journ. Nat. Hist., IV, 23, 1844.

*Leuciscus erythrogaster*, Günther, Cat., VII, 247, 1868.

*Chrosomus erythrogaster*, Jordan & Gilbert, Synopsis, 153, 1883; Cope, Cypr. Penn., 391, 1868.

Represented in the Susquehanna River by

### 334a. CHROSOMUS ERYTHROGASTER EOS (Cope).

Head 4; depth 5. D. 8; A. 8. Lateral line 77; teeth 5–5. Body slenderer than the preceding; the lateral line less distinct, often entirely wanting. Male with the two black lateral bands uniting on the caudal peduncle, the lower broader and decurved, the upper narrow and straight. Length $2\frac{1}{2}$ inches. Susquehanna River. (*ηώς*, sunrise.)

*Chrosomus eos*, Cope, Proc. Ac. Nat. Sci. Phila., 1861, 523, Meshoppen Creek, Susquehanna County, Pennsylvania; Cope, Cypr. Penn., 391, 1868; Jordan & Gilbert, Synopsis, 154, 1883. (Coll. Cope.)

### 335. CHROSOMUS DAKOTENSIS, Evermann & Cox.

Head $3\frac{8}{9}$; depth $4\frac{1}{2}$; eye $3\frac{1}{2}$; snout $4\frac{1}{2}$. D. 8; A. 8; scales about 80, 24 in a cross series; teeth 4–4, with slight grinding surface. Body moderately stout, head heavy, caudal peduncle shorter than in related species. Eye moderate; interorbital width 3 in head. Mouth small and oblique; maxillary short, not nearly reaching vertical at front of eye, its length $1\frac{1}{2}$ in eye; lower jaw projecting; fins moderate; height of dorsal $1\frac{1}{2}$ in head, its origin behind the base of ventrals a distance greater than length of snout; anal similar to dorsal; pectorals short, $1\frac{1}{2}$ in head; ventrals very short, not reaching anal. Color as in *C. erythrogaster*, except that the back is darker and the upper dark line is continuous and not at all broken up into spots; the lower black line is more distinct, broader, and does not end in a black spot. Length 2 inches. Missouri River basin, in Nebraska and South Dakota.

*Chrosomus dakotensis*, Evermann & Cox, Rept. U. S. Fish Comm., XIX, 1895, Crow Creek, Chamberlain, South Dakota. (Type, No. 45680. Coll. Evermann, Rutter, & Cox.)

### 336. CHROSOMUS OREAS, Cope.

Head 4; depth 4¼. D. 8; A. 8. Lateral line 67; teeth 5–5. Snout, preorbital, and maxillary a little longer than in *C. erythrogaster*. Coloration similar to that of *Chrosomus erythrogaster*, except for the difference in pattern, the upper band beginning opposite the vent and extending backward to middle of caudal, ending in a black spot; lower band extending from snout through eye downward and backward, ceasing at base of anal; back clear olive-green, with dark spots and crossbars; belly, interspace between the lateral bands, and bases of vertical fins bright crimson; fins otherwise yellow. Length 2½ inches. Head waters of Roanoke River. The most brilliant of the genus, locally abundant in mountain streams. Specimens of *erythrogaster* approaching *oreas* in coloration are also found in clear tributaries of the Tennessee River, in Alabama. (*oreas*, ὀρειάς, a mountain nymph.)

*Chrosomus oreas*, Cope, Journ. Ac. Nat. Sci. Phila., 1868, 233. Head of Roanoke River, Montgomery County, Virginia; (Coll. Cope); Jordan & Gilbert, Synopsis, 154, 1883; Jordan, Bull. U. S. Fish Comm., viii, 1888, 121.

## 106. ALGANSEA, Girard.

*Algansea*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 184, (*tincella*).

This genus is very closely related to *Hybognathus*, differing chiefly in the small size of the scales, there being 55 to 70 in the course of the lateral line; preorbital bones very wide, as in *Hybognathus;* teeth 4–4, scarcely hooked, with rather broad grinding surface; intestinal canal elongate; peritoneum black. Mountains of Mexico. (A coined name.)

*a*. Scales very small, about 70 in the lateral line; body and head robust.
  *b*. Dorsal inserted over ventrals; maxillary not reaching eye. TINCELLA, 337.
  *bb*. Dorsal inserted rather before ventrals; maxillary reaching front of eye. DUGESI, 338.
*aa*. Scales moderate, 55 to 60 in the lateral line; eye small. SALLÆI, 339.

### 337. ALGANSEA TINCELLA (Cuvier & Valenciennes).

Head 3¾; depth 3⅗; scales 17–70–9; teeth 4–4. Body stoutish, the head heavy. Mouth moderate, oblique, the maxillary not reaching to the eye; jaws about equal; eye rather small; fins small, the caudal short. Dorsal inserted just over ventrals. Scales quite small, firmly attached and not closely imbricated, as in *Mylocheilus* and *Gila*. Coloration dark, plain; fins unspotted. Length 6 inches. Lakes about the City of Mexico. (diminutive of *tinca*, a tench.)

*Leuciscus tincella*, Cuvier & Valenciennes, xvii, 323, 1844, City of Mexico; Günther, Cat., vii, 244, 1868. (Specimens, No. 2753, U. S. N. M.; original type in Museum of Paris. Coll. Maj. Wm. Rich.)
*Leucus tincella*, Jordan & Gilbert, Synopsis, 245, 1883.

### 338. ALGANSEA DUGESI, Bean.

Head 4; depth 4; eye 5½. D. 7; A. 6; scales 18–69 to 72–13. Teeth 4–4, slightly hooked, with well-developed grinding surface. Gill rakers 4+15. Body robust. Lower jaw slightly included, with a small knob at the symphysis; maxillary reaching opposite front of eye. Dorsal inserted somewhat before ventrals at a point midway between snout and base of caudal; lower fins short; caudal large. Scales very small and crowded anteriorly, larger behind; lateral line sharply decurved over pectoral. Dusky brown; sides of head silvery, a very faint dusky spot at base of caudal; upper fins dusky, unmarked. Length 6½ inches. Central Mexico, in streams tributary to Rio de Lerma; our specimens collected by Mr. Woolman, at Salamanca. Very close to *A. tincella*, but probably distinct. (Named for Professor Alfredo Dugès, who collected the types.)

*Algansea dugèsi*, BEAN, Proc. U. S. Nat. Mus., 1892, 283, Guanajuato, Lake Yuriria. (Type, Nos. 41818 and 43764.)

### 339. ALGANSEA SALLÆI (Günther).

Head 4; depth 3⅔; eye 5. D. 7; A. 6. Lateral line 54; teeth 4–4, long, curved, with grinding surface. Caudal peduncle not quite twice as long as deep. No barbels. Snout obtusely conical, longer than the eye. Upper jaw slightly overlapping the lower. Maxillary not extending to the eye. Dorsal immediately behind ventrals. Fins short. Intestinal canal with few convolutions. Brownish, green above, minutely dotted with black along the sides. Length 3½ inches. Streams of central Mexico. (Günther.) (Named for M. Sallé, a collector in Mexico, who obtained the types.)

*Ceratichthys sallæi*, GÜNTHER, Cat., VII, 484, 1868, Cuernavaca, Mexico.
*Zophendum australe*,* JORDAN, Proc. U. S. Nat. Mus., 1870, 300, Lake Tupataro. (Type, Nos. 23130 and 23131. Coll. Prof. A. Dugès.) JORDAN & GILBERT, Synopsis, 154, 1883.
*Hudsonius sallæi*, JORDAN, Proc. U. S. Nat. Mus., 1879, 226.
*Cliola sallæi*, JORDAN & GILBERT, Synopsis, 164, 1883.

## 107. HYBOGNATHUS, Agassiz

*Hybognathus*, AGASSIZ, Amer. Journ. Sci. Arts, 1855, 223, (*nuchalis*).
*Dionda*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 177, (*episcopa*).
*Algoma*, GIRARD, *l. c.*, 180, (*amara*).

Body elongate, somewhat compressed. Mouth horizontal, the jaws normal, sharp-edged; lower jaw with a slight, hard protuberance in front; no barbel; upper jaw protractile. Teeth 4–4, cultriform, with oblique grinding surface and little if any hook. Alimentary canal elongate, 3 to 10 times the length of the body. Peritoneum black. Scales large; lateral line continuous. Dorsal inserted before ventrals. Anal basis short. Size moderate. Sexual changes very slight, no red or black pigment distinguishing the males in spring. Species numerous; mostly southwestern, and not well known. (*ὑβός*, gibbous; *γνάθος*, jaw.)

HYBOGNATHUS:

- *a.* Teeth comparatively long and scarcely hooked; silvery species, usually more than 3½ inches in length when adult; scales about 38.
  - *b.* Suborbitals broad, the anterior not more than twice as long as deep.
    - *c.* Mouth narrow, its cleft not reaching nearly to eye; lower jaw shorter than upper, obtuse at tip. NUCHALIS, 340.
    - *cc.* Mouth wide, its cleft about reaching eye; jaws subequal, the lower acutish at tip. ARGYRITIS, 341.
  - *bb.* Suborbitals narrow, the anterior about 3 times as long as deep; mouth rather small. HAYI, 342.

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**Algansea australis*, (Jordan). Head 4; depth 4¼. D. 8; A. 7. Scales 10–56–8. Teeth 4–4. Body rather elongate, formed as in *Campostoma anomalum*, somewhat compressed, the back somewhat elevated and rounded anteriorly. Head rather large, slightly depressed above. Mouth moderate, low; the lower jaw slightly included; the premaxillary below the level of the eye; maxillary just reaching the front of the eye. Lower jaw thin-edged, with a slight symphyseal knob. Eye small, 6 in head. Scales small. Lateral line complete, decurved. Dorsal slightly behind ventrals. Dusky bluish above; everywhere with dark points; a black spot at base of caudal. Length 7 inches. Lake Tupataro, Guanajuato, Mexico, a tributary of Rio Lerma, west of the Sierra Madre. Doubtless the adult of *Algansea sallæi.*

DIONDA (a coined name):

- *aa.* Teeth comparatively short, distinctly hooked; suborbitals moderate; plumbeous species, usually with dark lateral band, the adult less than 3 inches long.
  - *d.* Scales in lateral line 32 to 43.
    - *e.* Body rather slender, the depth 4 to 4½ in length.
      - *f.* Scales large, 32 to 34 in lateral line. SERENA, 343.
      - *ff.* Scales smaller, usually 37 to 40 in the lateral line.
        - *g.* Sides with a dark lateral band, ending in a more or less distinct dark spot at base of caudal.
          - *h.* Cleft of mouth about 5 in head; snout bluntish. EPISCOPA, 344.
          - *hh.* Cleft of mouth about 4 in head, the snout more acute. NUBILA, 345.
        - *gg.* Sides without distinct dark lateral band or caudal spot; body elliptical in outline; eye 3⅓ in head, rather longer than snout. AMARA, 346.
    - *ee.* Body rather stout, the depth 3½ to 3¾ in length; scales about 37; sides with dusky band and caudal spot. MELANOPS, 347.
  - *dd.* Scales in lateral line 50 to 60; body rather slender, the depth 4⅓ in length. PLUMBEA, 348.

### Subgenus HYBOGNATHUS.

#### 340. HYBOGNATHUS NUCHALIS, Agassiz.

(SILVERY MINNOW.)

Head 4½ to 5; depth 4⅛; eye 4. D. 8; A. 7. Teeth 4–4; scales 5–38–4. Body elongate, comparatively slender. Head moderate, rather short, the profile evenly curved; suborbitals broad, the anterior about twice as long as deep. Eye moderate, rather longer than muzzle. Upper jaw heavy; lower jaw thin. Scales large and silvery. Lateral line decurved; 12 to 14 large scales in front of dorsal. Intestines very long, 7 to 10 times length of body. Olivaceous green above, translucent in life; sides clear silvery, with bright reflections; fins unspotted, coloration becoming dusky in specimens living in dark waters. Length 4 to 7 inches. A graceful minnow, abundant in clear streams from the Delaware and Neuse to the Upper Missouri and southward to Georgia and Texas; common in or near large rivers. Variable; tangible varieties are: subspecies *placita*, (Girard), from the Arkansas and Missouri rivers, the eye smaller, 5 in head; the snout depressed and blunt, with very small mouth; subspecies *regia*, (Girard), Potomac River, more than 6 inches long (western forms are usually less), with deeper body and larger eye, 3¾ in head; the form called *osmerinus*, from Delaware River, is not evidently different from *nuchalis*, which is the common form of the Missouri Valley. (*nuchalis*, pertaining to the nape.)

*Hybognathus nuchalis*, AGASSIZ, Amer. Journ. Sci. Arts, 1855, 224, Quincy, Illinois. (Coll. Dr. Watson.) GÜNTHER, Cat., VII, 184, 1868; JORDAN & GILBERT, Synopsis, 156, 1883.

*Hybognathus placitus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 182, sluices of the Arkansas River, Fort Makee, Arkansas. (Type, No. 87. Coll. Dr. Suckley.)

*Hybognathus evansi*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 182, Fort Pierre, Nebraska. (Coll. Dr. Evans.)

*Hybognathus regius*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 209, Potomac River. (Coll. Girard.) GÜNTHER, Cat., VII, 185, 1868.

*Hybognathus osmerinus*, COPE, Proc. Amer. Phil. Soc. Phila., 1870, 466, Raritan River, New Jersey. (Coll. C. C. Abbott.)

### 341. HYBOGNATHUS ARGYRITIS, Girard.

Mouth wider than in *H. nuchalis*, its cleft reaching to opposite front of eye; jaws subequal, the lower acutish at tip; suborbitals broad, the anterior about twice as long as deep. Silvery. Length 4 inches. Very close to *H. nuchalis* into which it may intergrade. Upper Missouri region and Red River of the North. (*argyritis*, ἀργυρῖτις, silvery.)

*Hybognathus argyritis*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 182, Milk River.

### 342. HYBOGNATHUS HAYI, Jordan.

Head $4\frac{2}{5}$; depth $4\frac{3}{7}$; eye $3\frac{2}{3}$; snout $4\frac{1}{3}$. D. 8; A. 8; scales 5–36–3; teeth 4–4. Body rather slenderer than in *H. nuchalis*, the profile more rapidly declined. Head small and low; snout short, less obtuse than in *nuchalis*; eye large; maxillary $5\frac{1}{2}$ in head, not quite reaching eye; suborbital bones very narrow, the anterior 3 times as long as deep. Scales and fins essentially as in *H. nuchalis*; color the same; intestine shorter, $4\frac{1}{2}$ to $7\frac{1}{2}$ times body. Length 4 inches. Lower Mississippi and neighboring rivers, known from Pearl River, from Memphis, Tennessee, and from streams in Mississippi. Perhaps a variety of *H. nuchalis*. (Named for Dr. Oliver P. Hay, discoverer of the species.)

*Hybognathus argyritis*, HAY, Bull. U. S. Fish Comm., II, 1882, 68, not of GIRARD; JORDAN & GILBERT, Synopsis, 968, 1883.

*Hybognathus hayi*, JORDAN, Proc. U. S. Nat. Mus., 1884, 548, Pearl River, Jackson, Mississippi. (Type, No. 32306. Coll. Hay.)

### Subgenus DIONDA, Girard.

### 343. HYBOGNATHUS SERENA (Girard).

Head $4\frac{2}{3}$; depth $4\frac{1}{2}$; eye $3\frac{1}{3}$. D. 8; A. 8; scales 5–32 to 34–3. Eye large, a little less than interorbital width. Ventral fin nearly reaching vent. Color dusky, with a black lateral band; fins plain. Length $2\frac{1}{2}$ inches. Rivers of Western Texas; with the next, from which it may be known by the larger scales. (*serenus*, serene.)

*Dionda serena*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 177, Sabinal River, Texas. (Type, No. 43. Coll. Kennerly.)

*Dionda papalis*, GIRARD, Proc. Ac. Nat Sci. Phila., 1856, 178, Delaware Creek, a tributary of Pecos River, Texas. (Coll. Capt. Pope.)

*Dionda chrysitis*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 178, Live Oak Creek, a tributary of Pecos River. (Coll. Clark.)

*Hybognathus nigrotæniata*, COPE, Bull. U. S. Nat. Mus., XVII, 37, 1881, Wallace Creek, a tributary of Medina River, Texas; JORDAN & GILBERT, Synopsis, 156, 1883.

### 344. HYBOGNATHUS EPISCOPA (Girard).

Head $4\frac{1}{2}$; depth $4\frac{1}{3}$ to $4\frac{1}{2}$; eye large, $2\frac{2}{3}$ to $3\frac{1}{2}$. D. 8; A. 8; scales 9-37 to 41-4. Slender, fusiform in profile, and compressed, with the back slightly arched. Head large, the snout decurved to the small, terminal mouth, the maxillary reaching about half way to the eye. Dusky above, a blackish band along the sides, ending in a dusky blotch at base of caudal; fins yellowish, unmarked; scales with fine black dots. Length 3 inches. Rivers of Western Texas and Northeastern Mexico from Rio Comal to Rio

Grande; abundant. (*ἐπισκόπος*, bishop or pope, a remote allusion to Captain, afterwards General, John Pope, in charge of the party by which the species was collected.)

*Dionda episcopa*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 177, headwaters of Pecos River, and Comanche Spring, tributary to Rio Grande. (Type, No. 45. Coll. Capt. Pope.)
*Dionda texensis*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 177, Nueces River, Texas. (Type, No. 44. Coll. Clark.)
?*Dionda argentosa*[1], GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 178, San Felipe Creek and Devil River, tributaries of the Rio Grande, in Texas. (Type, No. 32. Coll. Clark.)
*Hybognathus flavipinnis*, COPE, Bull. U. S. Nat. Mus., XVII, 36, 1880, Johnson's Fork of Llano River, in Kimble County, Texas; JORDAN & GILBERT, Synopsis, 156, 1883.
?*Hybognathus (Dionda) punctifer*[2], GARMAN, Bull. Mus. Comp. Zoöl., VIII, 89, 1881, Parras, and spring near Saltillo, Coahuila, Mexico; JORDAN & GILBERT, Synopsis, 884, 1883.
*Hybognathus civilis*[3], COPE, Trans. Amer. Philo. Soc., 1884, 167, Monterey, New Leon.
*Hybognathus episcopus*, JORDAN & GILBERT, Synopsis, 156, 1883.
*Dionda punctifer* and *episcopa*, EVERMANN & KENDALL, Bull U. S. Fish Comm., XII, 1892, 99.

### 345. HYBOGNATHUS NUBILA (Forbes).

Head 4½; depth 4; eye 3. D. 8; A. 9; scales 5–37–3; teeth 4–4, little hooked. Head narrow; mouth inferior and horizontal. Lateral line anteriorly deflexed. Eye large, rather longer than muzzle. 14 scales before dorsal. Color very dark; a dark lateral band from muzzle to base of caudal; fins all plain. Length 2¼ inches. Western Illinois, west to Wyoming, and southwest to the Ozark region, abundant. Close to *H. episcopa*, but differing in the more pointed snout and larger mouth, the cleft 4 in head, not 5 as in *H. episcopa*. (*nubilus*, dusky.)

*Alburnops nubilus*, FORBES, Bull. Ill. Lab. Nat. Hist., II, 56, 1878, Rock River, Ogle County, Illinois. (Type, No. 28410. Coll. Forbes.)
*Cliola nubila*, JORDAN & GILBERT, Synopsis, 167, 1883.

### 346. HYBOGNATHUS AMARA (Girard).

Head 4; depth 4; eye 3½. Dorsal 8; A. 7; lateral line 35 to 38; teeth 4–4. Body elliptical, rather chubby. Head short and blunt; front convex. Suborbital bones rather narrow. Eye moderate, about as long as snout. Scales moderate, 16 in front of the dorsal. Silvery; no dark lateral band, nor caudal spot. Rio Grande. Possibly the young of *H. nuchalis* or some similar species; perhaps identical with *H. argentosa*. (*amarus*, bitter, the type being found in brackish water.)

*Algoma amara*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 180, Lagoon near Fort Brown, Texas. (Type, No. 149. Coll. Clark.)
*Algoma fluviatilis*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 181, near Monterey, New Leon; GIRARD, U. S. & Mex. Bound. Surv., Zoöl., 45, pl. XXVII, figs. 17-20, 1859. (Coll. Couch.)
*Hybognathus fluviatilis*, JORDAN & GILBERT, Synopsis, 157. In Girard's figure, *fluviatilis* has smaller scales than *amara*, about 40 in lateral line, but the plates of the Mexican Boundary Survey are very untrustworthy.
*Hybognathus amarus*, JORDAN & GILBERT, Synopsis, 156, 1883.

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[1] One of the types of *D. argentosa*, recently examined, gives: Head 3⅘; depth 3¾; eye 3⅔, and is heavier and stouter than typical *episcopa*; the dorsal is less anterior. Possibly a distinct species.

[2] *Hybognathus punctifer*, GARMAN, from Laguna del Muerte, Coahuila is not evidently different. Scales 5–40–3. Head 4; depth 4; the form stouter than in *H. episcopa*.

[3] *Hybognathus civilis*, COPE, from Monterey, New Leon, is also not appreciably different. Lateral stripe faint or obsolete; depth of body equal to length of head, 5¼ in total with caudal; eye 3⅔ in head; pectorals not reaching ventrals.

All these last (*argentosa*, *punctifer*, *civilis*) may belong to a distinct species, (*Hybognathus argentosa*), allied to *H. episcopa*, but stouter, with smaller eye, and the lateral band faint or obsolete, the "sides silvery as if painted with quicksilver."

### 347. HYBOGNATHUS MELANOPS (Girard).

Head 4 to 4¼; depth 3½ to 3¾. D. 8; A. 7; scales 7–36 to 38–4; teeth 4-4. Body deeper than in related species; snout rounded; eye medium. Blackish above, sides smoky, with black dots; a black spot at base of caudal. Length 2½ inches. Streams of Coahuila, Chihuahua, and Nuevo Leon. Two specimens collected by Mr. Woolman in Chihuahua River agree with *H. episcopa* in all respects except that the depth is 3¾ and the scales 42 or 43. It is doubtful whether the two species are really distinct. (*μέλας*, black; *ὤψ*, eye.)

*Dionda melanops*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 178, Buena Vista, Coahuila. (Type, No. 41. Coll. Couch.)

*Dionda couchi*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 178, Guajuco, Monterey, and Cadereita, New Leon. (Type, No. 103, (20227). Coll. Möllhausen.)

*Hybognathus melanops*, Jordan, Bull. U. S. Geol. Surv., IV, No. 2, 402, 1878.

### 348. HYBOGNATHUS PLUMBEA* (Girard).

Head 4⅓; depth 4⅓. D. 8; A. 7; lateral line 53 to 58. Body rather slender. Head moderate, rounded in front. Lower jaw included. Dorsal inserted before ventrals. Color uniform, sometimes a black spot at the base of the caudal. Tributaries of Arkansas River in Indian Territory. (Girard.) (*plumbeus*, lead-colored.)

*Dionda plumbea*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 178, Canadian River. (Coll. Möllhausen.

*Dionda spadicea*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 178, Fort Smith, Arkansas. (Coll. Möllhausen.)

*Dionda grisea*, Girard, Pacific R. R. Surv., x, 230, pl. LII, figs. 6–10, 1858, 20 miles west of Choctaw Agency. (Coll. Möllhausen.)

*Zophendum plumbeum*, Jordan & Gilbert, Synopsis, 155, 1883.

## 108. PIMEPHALES, Rafinesque.

(Fat-heads.)

*Pimephales*, Rafinesque, Ichth. Oh., 52, 1820, (*promelas*).

*Hyborhynchus*, Agassiz, Amer. Journ. Sci. Arts, 1855, 22, (*notatus*).

*Coliscus*, Cope, Hayden's Rept. Geol. Surv. of Wyoming, 1872, 437, (*parietalis* = young of *promelas*).

Body rather robust, little compressed. Head short and rounded. Mouth small, inferior; upper jaw protractile; no barbel. Teeth 4–4, with oblique grinding surface, usually but one of the teeth hooked. Dorsal over ventrals, its first (rudimentary) ray separated from the rest by membrane, not adnate to it, as usual in minnows; this character is most distinct in adult males, in which the skin of the first ray is thickened. Anal basis short. Intestinal canal elongate. Peritoneum black. Pseudobranchiæ present. Scales rather small. Lateral line complete or variously incomplete. Size small. Breeding males with much black pigment and with large warts on the head. (*πιμελής*, fat; *κεφαλή*, head.)

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|---|---|
| *a.* Lateral line more or less incomplete; body very short and stout. | PROMELAS, 349. |
| *aa.* Lateral line complete; body moderately elongate. | NOTATUS, 350. |

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*The nominal species here united as *Hybognathus plumbea* are all unknown to us. Girard figures all of them as having small scales, some 53 to 58 in the lateral line. In general appearance these figures seem to agree, and except for the scales, they seem to be close to the other species called *Dionda*. It is possible that their relations are with *Algansea* rather than *Dionda*. It may also be that the scales are erroneously figured by Girard.

### 349. PIMEPHALES PROMELAS, Rafinesque.

(Fat-head; Black-head Minnow.)

Head 4; depth 4; D. I, 7; A. 7; scales 7–43 to 47–6; teeth 4-4. Body very short and deep. Head short, everywhere convex, almost gobular in adult males. Mouth small, inferior, horizontal. Scales deep, closely imbricated. Lateral line extremely variable, sometimes nearly complete (*confertus*), sometimes almost wanting, (typical *promelas*). Olivaceous, the dorsal with a large black bar across it, nearly half way up, most distinct anteriorly, appearing as a simple dusky shade in the young. Male fish dusky, the head jet-black, with several large tubercles on the snout in spring; a dusky shade along sides of caudal peduncle. Length 2½ inches. Lake Champlain to Kentucky, Dakota, and the Rio Grande; abundant in sluggish brooks, especially in the Missouri Basin. Varies greatly with age, sex, and season. (*πρό*, before; *μέλας*, black.)

*Pimephales promelas*, Rafinesque, Ichth. Oh., 53, 1820, pond near Lexington, Kentucky; (Coll. Wm. M. Clifford); Günther, Cat., vii, 181, 1868; Jordan & Gilbert, Synopsis, 158, 1883.

*Pimephales fasciatus*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 180, Yellowstone River. (Coll. Hayden.)

*Plargyrus melanocephalus*, Abbott, Proc. Ac. Nat. Sci. Phila., 1860, 325, Lake Whittlesey, Minnesota. (Type, No. 3374. Coll. Abbott.)

*Pimephales milesi*,* Cope, Proc. Ac. Nat. Sci. Phila., 1864, 282, Grosse Isle, Detroit River, Michigan. (Coll. Miles.) Günther, Cat., vii, 181, 1868.

*Pimephales agassizii*, Cope, Cypr. Penn., 394, 1866, Miami River, tributary near Richmond, Indiana.

*Coliscus parietalis*, Cope, Hayden's Report for 1870, Geolog. Surv. of Wyoming, 437, 1871, Saint Joseph, Missouri. (Coll. Hayden.) Jordan & Gilbert, Synopsis, 158, 1883.

Represented in Arkansas and Indian Territory by the closely related

### 349a. PIMEPHALES PROMELAS MACULOSUS (Girard).

Differs only in having the lateral line better developed; the pores wanting on less than half the scales. Coloration, so far as known, as in *P. promelas*. Arkansas River, locally abundant, probably in other streams from Kansas to Texas. (*maculosus*, spotted.)

*Pimephales maculosus*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 180, Sluices of Arkansas River, Fort Makee, Arkansas; (Type, No. 153, (2729). Coll. Beckwith.) Girard, Pac. R. R. Surv., x, 234, 1858.

*Hyborhynchus nigellus*, Cope, Zoöl. Wheeler Surv., v, 671, 1875, (1876), Arkansas River, Pueblo, Colorado. (Type, Nos. 15793 and 15784. Coll. Aiken.)

*Hyborhynchus confertus*, Jordan & Gilbert, in part, Synopsis, 159, 1883.

Represented in the Rio Grande basin by

### 349b. PIMEPHALES PROMELAS CONFERTUS (Girard).

Similar to the variety *maculosus*, but more chubby, and the male apparently differently colored. An adult male from the Chihuahua River, collected by Mr. Woolman, is black, with two broad white cross bands, the one across the gill opening, including edge of opercle and shoulder girdle; the other under front of dorsal. Another band, less distinct,

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**Pimephales milesi* may be a tangible variety; the scales are said to be 40, with only 3 series between the lateral line and the ventrals, while there are usually 5 to 7 in *P. promelas*.

across base of caudal; pectoral fins white, except the black outer edge, which is followed by a narrow, sharply-defined streak of bright silvery; other fins white, the middle portions black; head all black. Lateral line complete. (*confertus*, compact.)

*Hyborhynchus confertus*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 179, (♀), Hurrah Creek, a tributary of Pecos River, Texas. (Coll. Möllhausen.) Jordan & Gilbert, in part, Synopsis, 159, 1883.

### 350. PIMEPHALES NOTATUS[*] (Rafinesque).

(Blunt-Nosed Minnow.)

Head 4½; depth 5; D. I, 8; A. 7; scales 6–45–4; teeth 4–4. Body rather elongate, not elevated, moderately compressed. Head moderate; the muzzle blunt and convex; top of the head depressed. Cheeks vertical. Mouth small, inferior, horizontal. Fins small; the dorsal moderate, the first ray distinct and spine-like in the male, slender in the female; anal small, caudal fin short. Scales moderate, deep, closely imbricated; scales in front of dorsal small and crowded, in 23 rows. Eye moderate. Color olivaceous, little silvery; sides bluish; a black spot on the dorsal fin in front, near the base, less distinct than in *Cliola vigilax*; a dusky shade at base of caudal; fins often reddish; males in spring with the black on the dorsal more extended and the head wholly black; snout with about 14 disproportionately large tubercles. Length 4 inches. Quebec to Delaware, Kentucky, Alabama, Arkansas, and northward to the Dakotas; generally very abundant in small streams west of the Alleghanies. (*notatus*, noted or spotted.)

*Minnilus notatus*, Rafinesque, Ichth. Oh., 47, 1820, Ohio River.

*Catostomus melanotus*, Rafinesque, Ichth. Oh., 58, 1820, Ohio River.

*Hyborhynchus perspicuus*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 185, Arkansas River, Fort Smith. (Type, No. 144. Coll. Shumard.)

*Hyborhynchus tenellus*, Girard, *l. c.*, 179, Choctaw Agency. (Coll. Möllhausen.)

*Hyborhynchus puniceus*, Girard, *l. c.*, 179, Antelope Creek, Canadian River. (Coll. Kennerly.)

*Hybopsis hæmaturus*, Cope, Cypr. Penn., 382, 1866, St. Joseph River, Michigan; Michigan City, Indiana.

*Hyborhynchus superciliosus*, Cope, Journ. Ac. Nat. Sci. Phila., 1868, 234; Kanawha River. (Breeding males with the lips thickened). (Type, No. 20532. Coll. Cope.) Jordan & Gilbert, Synopsis, 160, 1883.

*Hyborhynchus notatus*, Günther, Cat., vii, 182, 1868; Jordan & Gilbert, Synopsis, 159, 1883.

*Hybognathus perspicuus*, Günther, Cat., vii, 185, 1868.

*Leuciscus hæmaturus*, Günther, Cat., vii, 259, 1868.

*Cliola hæmatura*, Jordan & Gilbert, Synopsis, 166, 1883.

## 109. MYLOPHARODON, Ayres.

*Mylopharodon*, Ayres, Proc. Cal. Ac. Nat. Sci., 1855, 33, (*robustus*).

Body elongate; head large, pike-like, the upper jaw not protractile; no barbel. Teeth 2, 4–5, 2; 2 or 3 of the teeth in the main row molar, truncate or bluntly rounded at the apex, much enlarged. Mouth terminal, rather large, with thickened lips. Scales rather small; lateral line continuous. Dorsal fin inserted behind the ventrals. Anal basis short. Size very large. Pacific slope. This genus resembles *Mylocheilus*, from which it differs in the nonprotractility of the upper jaw. Both represent a comparatively primitive type of *Cyprinidæ*, allied to Asiatic forms. (Shortened from *Mylopharyngodon*—*μύλος*, grinder; *φάρυγξ*, pharynx; *ὀδούς*, tooth.)

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[*] The following nominal species is probably the young of *Pimephales notatus*: *Hybopsis hæmaturus*, Cope. Head 4; depth 4⅘; eye 3½. D. 8; A. 7; scales 7–44–4; teeth 4–4, little hooked. Head moderate, the muzzle little obtuse. Mouth moderate, terminal, oblique, the maxillary reaching orbit; temporal region rounded. Scales rather small, 21 rows in front of dorsal. Lateral line slightly decurved. Plumbeous above; head blackish; a faint dusky lateral band, ending in a dusky spot at root of caudal fin; caudal fin dull red; fins otherwise plain. Length 3 inches. Streams about the head of Lake Michigan. Said to be abundant. (Cope.) (*ἅιμα*, blood; *οὐρά*, tail.)

### 351. MYLOPHARODON CONOCEPHALUS (Baird & Girard).

Head 3½; depth 4⅔; eye 7. D. 8; A. 8; scales 17–74–7. Body elongate, subfusiform, compressed. Head broad and depressed, the snout tapering. Mouth horizontal, the jaws about equal, the maxillary extending to eye. Eye small, 2½ in snout; preorbital elongate. Interorbital space as long as maxillary, 3 in head. Scales rather small, loosely imbricated. Dorsal fin a little behind ventrals. Caudal fin 1½ in head, the lower lobe very long, longer than upper; caudal peduncle very long, 4½ in length. Color dark, paler below, no red. Length 2 to 3 feet. Sacramento and San Joaquin rivers; not very common; next to the species of *Ptychocheilus*, the largest of our *Cyprinidæ*. (*κῶνος*, cone; *κεφαλή*, head.)

*Gila conocephala*, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 134, San Joaquin River. (Coll. Heermann.)

*Mylopharodon robustus*, AYRES, Proc. Cal. Ac. Nat. Sci., 1855, 33, San Francisco. (Coll. Ayres.)

*Mylopharodon conocephalus* and *robustus*, GIRARD, Pac. R. R. Surv., x, 216, 1858.

*Mylopharodon conocephalus*, GÜNTHER, Cat., VII, 262; JORDAN & GILBERT, Synopsis, 225, 1883.

## 110. MYLOCHEILUS, Agassiz.

*Mylocheilus*, AGASSIZ, Amer. Journ. Sci. Arts., 1855, 229, (*lateralis*).

Body elongate, not elevated, little compressed. Head rather short, conic, somewhat pointed. Mouth rather small, little oblique, the lower jaw included; maxillary with a small barbel at its end; upper jaw protractile. Scales moderate, not closely imbricated. Lateral line decurved. Dorsal fin beginning nearly opposite ventrals. Caudal fin with the rudimentary rays little developed. Anal basis short. Intestinal canal about as long as body. Teeth 2, 5–5, 2, or 2, 5–4, 2, those in the main row hooked in the young; 2 or 3 of these becoming molar with age, much enlarged, blunt and truncate above. (A third deciduous row sometimes present, according to Girard, in this genus and in *Mylopharodon*; we have seen nothing of the kind.) Size large. Pacific Slope. (*μύλος*, grinder; *χεῖλος*, lip.)

### 352. MYLOCHEILUS CAURINUS (Richardson).

(COLUMBIA CHUB.)

Head 4⅖; depth 4½; eye 5; snout 3½. D. 8; A. 8; scales 12–77–7; teeth 1, or 2, 5–5, 2 or 1. Interorbital space broad, convex. Mouth horizontal or nearly so, the maxillary not reaching the front of the eye; suborbital bones wide; preorbital elongate. Teeth hooked in the young, some of them becoming stump-like with age. Color dark above; sides silvery, a dark lateral band; below this a pale stripe, under which is a dark stripe, which extends about to the vent; fins plain; belly and pale stripe red in spring males. Length 12 inches. Streams of Oregon and Washington, from Frazer River, southward, ascending Clark's Fork of the Columbia as far as Flathead Lake, (Evermann), and Snake River to Shoshone Falls, (Gilbert & Evermann); often entering the sea; abundant northward; frequents the spawning beds of the salmon where it devours their eggs. Specimens from Nanaimo sent us by Mr. Ashdown H. Green, who says that this is the only *Cyprinoid* found in Vancouver Island. (*caurus*, the northwest wind, hence *caurinus*, north western.)

*Cyprinus* (*Leuciscus*) *caurinus*, Richardson, Fauna Boreali Amer., III, 304, 1836, Columbia River at Fort Vancouver.

*Mylocheilus fraterculus*,* Girard, Proc. Ac. Nat. Sci. Phila., 1856, 158, said to be from Monterey, California, probably erroneously. (Type, No. 211 (2768). Coll. Trowbridge.)

*Mylocheilus lateralis*, Agassiz & Pickering, Amer. Journ. Sci. Arts, 1855, 299, Columbia River at Fort Vancouver. (Type, No. 212. Coll. Suckley.)

*Leucosomus caurinus*, Günther, Cat., VII, 270, 1868.

*Mylocheilus caurinus*, Jordan & Gilbert, Synopsis, 224, 1883; Evermann, Bull. U. S. Fish Comm., XI, 1891, 43, pl. 19, fig. 2.

## 111. STYPODON, Garman.

*Stypodon*, Garman, Bull. Mus. Comp. Zoöl., VIII, 90, 1881, (*signifer*).

Body oblong, compressed, covered with large, deciduous scales. Lateral line complete, decurved. Dorsal and anal fins short. Mouth small, anterior; premaxillaries protractile; fold of lower lip not crossing the symphysis; lower jaw trenchant, without horny covering; no barbels. Gill rakers short. Pharyngeals strong. Teeth 3–3, of the *Mylocheilus* type, more or less cylindrical, with rounded grinding surfaces; posterior, more slender and subconical. (*στύπος*, stump; *ὀδούς*, tooth.)

### 353. STYPODON SIGNIFER, Garman.

Head 3⅔; depth 3⅔. D. 8; A. 8. Scales 6–35–2. "Teeth 3–3, stout, stump-like, with convex summits." Dorsal and ventral outlines similar; eye large, longer than snout. Mouth oblique, the maxillary not reaching front of eye; lower jaw the longer. Pectorals not reaching ventrals, the latter to anal. Brown; silvery below; a broad, brown lateral band, bordered above by a narrow silvery line. Lago de Parras, an isolated lagoon in Coahuila, Mexico. (Garman.) A singular fish of uncertain relations, known only from the original type. (*signum*, sign; *fero*, I bear.)

*Stypodon signifer*, Garman, Bull. Mus. Comp. Zoöl., VIII, 90, 1881, Lago de Parras, Coahuila, Mexico; Jordan & Gilbert, Synopsis, 224, 1883.

## 112. SEMOTILUS, Rafinesque.

### (Fall-fishes.)

*Semotilus*, Rafinesque, Ichth. Oh., 49, 1820, (*dorsalis* = *atromaculatus*).

*Leucosomus*, Heckel, Russeggers Reisen, I, 1843, 1042, ("*chrysoleucus*" = *corporalis*).

*Cheilonemus*, Baird, in Storer's Hist. Fishes Mass., 285, 1855, (*pulchellus* = *corporalis*).

Body robust; head large; mouth terminal, wide, the upper jaw protractile; a small barbel on the maxillary just above its extremity, not at its tip as in most other American minnows. (In young examples the barbel can not always be found.) Intestinal canal short; teeth 2, 5–4, 2,

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**Mylocheilus fraterculus*, Girard. According to Girard's description and figure this species is slenderer than *Mylocheilus caurinus*, with shorter head and smaller scales. Head 4⅘ in length; scales in lateral line about 85. D. 8; A. 9. Monterey, California, (Girard). No recent collector has found any *Mylocheilus* in California and this locality needs confirmation. (*fraterculus*, a little brother.)

hooked, without grinding surface. Scales moderate. Lateral line continuous. Dorsal more or less posterior to ventrals. Anal basis short. Vertebræ 22+20 = 42. Species of large size, the largest of the chubs found in Eastern America, differing from *Leuciscus* in the presence of a maxillary barbel. (*σῆμα*, banner, i. e., dorsal fin; the second part of the word was elsewhere used by Rafinesque to mean "spotted.")

LEUCOSOMUS: (λευκός, white; *σῶμα*, body):
- *a.* Origin of dorsal midway between nostril and base of caudal, between 13th and 14th vertebræ; scales not much crowded anteriorly.
  - *b.* Dorsal without black spot; scales large, silvery, about 45 in lateral line. CORPORALIS, 354.

SEMOTILUS:
- *aa.* Origin of dorsal midway between middle of orbit and base of caudal, between 15th and 16th vertebræ. Scales crowded anteriorly.
  - *c.* Dorsal with a black spot at base of its anterior rays; scales smaller, little silvery, 45 to 65 in lateral line. ATROMACULATUS, 355.

### Subgenus LEUCOSOMUS, Heckel.

### 354. SEMOTILUS CORPORALIS (Mitchill).

(FALL-FISH; SILVER CHUB; WIND-FISH; CORPORAL.)

Head 4; depth 4; eye 4½. D. 8; A. 8; scales 8–45–4; teeth 2, 5–4, 2. Body oblong, robust, little compressed. Head large, convex, the snout bluntly conic; mouth large, terminal, somewhat oblique, the lower jaw included; premaxillary below the level of the eye, the maxillary barely reaching front of orbit. Eye moderate, rather high up and anterior. Barbel shorter than pupil, not evident in young specimens. Scales large, 22 in front of dorsal, not much crowded anteriorly. Dorsal fin slightly behind middle of body, just behind ventrals, inserted behind 13th vertebra. Fins moderate. Coloration brilliant; steel-blue above; sides and belly silvery; males in spring with the belly and lower fins rosy or crimson; no spots on the fins. Length 18 inches. Abundant from the St. Lawrence to the James, east of the Alleghanies, in clear, swift streams, rock pools, below cataracts, and in clear lakes; not found west of the Alleghanies. It is much the largest of the eastern *Cyprinidæ*, ranking with the western and some European forms. "The chub is a soft fish and tastes like brown paper, salted." (Thoreau.) (*corporalis*, pertaining to the body; Mitchill calls the fish *Corporal* or *Corporaalen.*)

*Cyprinus corporalis*,* MITCHILL, Amer. Monthly Mag., I, July, 1817, 289, preliminary notice, Wallkill River; MITCHILL, *l. c.*, ii, February, 1818, 324, detailed description.
*Cyprinus bullaris*, RAFINESQUE, Amer. Monthly Mag., I, December, 1817, 120, Hudson River and Wood Creek.
*Leuciscus argenteus*, STORER, Fishes Mass., 90, 1839, Worcester County, Mass.
*Leuciscus pulchellus*, STORER, Fishes Mass., 90, 1839, Walpole, Mass.
*Leuciscus nitidus*, DEKAY, N. Y. Fauna: Fishes, 209, 1842, Lake Champlain.
*Leuciscus chrysopterus*, DEKAY, N. Y. Fauna: Fishes, 211, 1842, N. Y. Harbor.
*Leuciscus rotengulus*, CUVIER & VALENCIENNES, XVII, 318, 1844, Carolina.
*Leuciscus pulchellus*, STORER, Synopsis, 412, 1845, Massachusetts.
*Leucosomus cataractus*,† BAIRD in Iconog. Encycl., II, 216, and in COPE, Proc. Ac. Nat. Sci. Phila., 1861, 523, Susquehanna River.

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* As to the priority of the names of Mitchill and Rafinesque, see note under *Notropis cornutus.* This species is evidently Mitchill's *Cyprinus corporalis*, and the transfer of the name *Semotilus corporalis* to the next species by Abbott, Putnam, and Cope, has been an unfortunate and confusing error.

† According to Cope, the nominal species, *cataractus* and *rhotheus*, differ from the northern form, *pulchellus* (or *corporalis*), in the smaller scales, these having 47 in the lateral line, while *pulchellus* in Massachusetts has 59. This difference has not been verified by later writers, who place all under one head. Günther counts 45 to 48 in specimens mostly from Maine and Canada.

*Leucosomus rhotheus*, Cope, Proc. Ac. Nat. Sci. Phila., 1861, 523, Brandywine Creek and Rancocos Creek, tributaries of the Delaware River.
*Squalius hyalope*, Cope, Proc. Ac. Nat. Sci. Phila., 1864, 280, Conestoga River, Pa.; young.
*Cheilonemus pulchellus*, Storer, Fishes Mass., 286, 1867.
*Leucosomus pulchellus*, Günther, Cat., vii, 268, 1868.
*Semotilus bullaris*, Jordan & Gilbert, Synopsis, 222, 1883.

### Subgenus SEMOTILUS.

#### 355. SEMOTILUS ATROMACULATUS (Mitchill).

(Horned-dace; Creek-chub.)

Head 3¾; depth 4; eye about 5. D. 7; A. 8: scales 9–55–6, those in lateral line varying from 50 to 60 or even more, the number greatest in northern examples; teeth 2, 5–4, 2. Body stout, the dorsal outline arched in front of the dorsal, the body tapering backwards from a point considerably in advance of the dorsal, so that the base of that fin is oblique. Head large and heavy, broad and rounded above; snout broad; mouth broad, oblique, lower jaw slightly included, the upper lip just below level of pupil; maxillary barely reaching front of pupil; maxillary barbel small, not evident in specimens of less than 2 or 3 inches in length. Eye rather small. Scales small, considerably crowded, and reduced anteriorly; about 30 series in front of the dorsal fin. Lateral line considerably decurved. Fins small; the dorsal well behind ventrals, inserted behind fifteenth vertebra, its last ray well in advance of base of anal. Color dusky bluish above; sides with a vague, dusky band, black in the young, disappearing in the adult; belly creamy, rosy-tinted in males in spring; dorsal fin always with a conspicuous black spot at the base in front, which is bordered with red in the male; a dark vertebral line; scales everywhere edged with dark punctulations; a dusky bar behind opercle; males with snout coarsely tuberculate in spring. Young with a small black caudal spot. Length 10 inches. Maine (Freeport; Kendall Smith) and western Massachusetts (Housatonic River, Jordan), to southern Missouri, Wyoming, and Canada; everywhere abundant; chiefly in small brooks, where it is often the largest and most voracious inhabitant. (*ater*, black; *macula*, spot.)

*Cyprinus atromaculatus*, Mitchill, Amer. Monthly Mag., ii, 1818, 324, Wallkill River.
*Semotilus dorsalis*, Rafinesque, Ichth. Oh., 49, 1820, Kentucky River.
*Semotilus cephalus*, Rafinesque, Ichth. Oh., 49, 1820, Ohio River.
*Semotilus diplemius*, Rafinesque, Ichth. Oh., 49, 1820, Ohio River.
*Leuciscus iris*, Cuvier & Valenciennes, Hist. Nat. Poiss., xvii, 255, 1844, New York and Carolina.
*Leuciscus storeri*, Cuvier & Valenciennes, xvii, 255, 1844, New York.
*Leuciscus pulchelloides*, Ayres, Proc. Bost. Soc. Nat. Hist., 1849, 157, Connecticut.
*Leucosomus pallidus*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 190, (lateral line 52), Antelope Creek, Arkansas. (Coll. Kennerly.)
*Leucosomus incrassatus*, Girard, *l. c.*, 1856, 190, (lateral line 64), Choctaw Agency. (Coll. Möllhausen.)
*Semotilus macrocephalus*, Girard, *l. c.*, 1856, 204, Fort Pierre, Nebraska. (Coll. Evans.)
*Semotilus speciosus*, Girard, *l. c.*, 1856, 204, Sweetwater River, Nebraska. (Coll. Bowman.)
*Semotilus hammondi*, Abbott, Proc. Ac. Nat. Sci. Phila., 1860, 474, Kansas. (Coll. Hammond.)
*Semotilus corporalis*, Jordan & Gilbert, Synopsis, 221, 1883; Cope, Cyp. Penn., 363, 1866; not *Cyprinus corporalis*, Mitchill.
*Leucosomus corporalis*, Günther, Cat., vii, 269, 1868.
*Semotilus atromaculatus*, Bicknell & Dresslar, Proc. Ac. Nat. Sci. Phila., 1885, 16.

Represented south of Virginia and Tennessee by

### 355 a. SEMOTILUS ATROMACULATUS THOREAUIANUS (Jordan).

Head 4; depth 4. D. 8; A. 7; scales 9–46*–5; teeth 2, 5–4, 2. Rather stouter, with larger scales, less crowded forwards, 45 to 48 in lateral line; the head short and thick, almost round. Barbel well developed. Coloration of *S. atromaculatus*, the black dorsal spot distinct. Length 7 inches. Streams of Georgia and Alabama; the extremes quite unlike *atromaculatus*; intermediate specimens with scales 48 to 50 occurring in Cape Fear River and elsewhere. (Named for Henry David Thoreau, † naturalist and poet.)

*Semotilus thoreauianus*, JORDAN, Bull. U. S. Nat. Mus., x, 63, 1877, Flint River, Georgia. (Type, No. 9296. Coll. Hugh M. Neisler.)

## 113. POGONICHTHYS, Girard.

*Pogonichthys*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 136, (*inæquilobus*).
*Symmetrurus*, JORDAN, Bull. Hayden Geol. Surv. Terr., IV, 788, 1878, (*argyreiosus* = young).

Body elongate; head small, conical; mouth moderate, terminal, normal; maxillary with a well-developed barbel at its end; premaxillaries protractile. Teeth 2, 4–5, 2, or 2, 5–5, 2, hooked, with well-marked grinding surface. Scales rather large; lateral line continuous, decurved. Dorsal fin beginning rather in advance of ventrals; anal basis short. Caudal fin with its rudimentary rays numerous and greatly developed, supported by strong apophyses of the caudal vertebræ, the upper lobe of the fin considerably longer than the lower, this character not evident in the young, appearing by degrees. Intestinal canal short; skeleton not peculiar, except in the great development of the apophyses of last caudal vertebræ. Chubs of large size, replacing on the Pacific Slope, the eastern *Semotilus*. (πώγων, beard; ἰχθύς, fish.)

### 356. POGONICHTHYS MACROLEPIDOTUS (Ayres).

(SPLIT-TAIL.)

Head 4⅕; depth 3¾; eye large, 4¼ in head. D. 9; A. 8; scales 10–66–6; vertebræ 26+15; teeth 2, 5-5, 2, rarely 2, 6–5, 2. Body elongate, somewhat compressed, back a little elevated. Head short, slender. Mouth moderate, nearly horizontal, maxillary reaching orbit; lower jaw included; preorbital longer than deep. Interorbital space convex. Dorsal fin midway of body, rather in front of ventrals. Scales rather large, moderately imbricated. Lateral line decurved. Fins rather large; upper lobe of caudal half longer than head in adult, the lobes subequal in young. Coloration uniform; sides bright silvery, especially in young; no red. Length 12 inches. Lowland streams of central California; very common in the Sacramento and San Joaquin. Singularly distinguished from our other *Cyprinidæ* by the great development of the upper lobe of the caudal and its rudimentary rays. (*μακρολεπιδοτός*, large-scaled.)

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* Scales 46 to 48 in the types from Flint River; 51 in specimen from Augusta, Georgia; 52 in one from Black Warrior River.

† "The first to say a good word for the study of Cyprinidæ." "I am the wiser in respect to all knowledge and the better qualified for all fortunes for knowing that there is a minnow in the brook. Methinks I have need even of his sympathy and to be his fellow in a degree. I would know even the number of their fin rays and how many scales compose the lateral line." (*Thoreau.*)

*Leuciscus macrolepidotus*, Ayres, Placer Times and Transcript, 1854, May 30, San Francisco.

*Pogonichthys inæquilobus*, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1854, 136, (August), San Joaquin River, California; and Girard, Pac. R. R. Surv., x, 245, 1858.

*Pogonichthys argyreiosus*, Girard, Proc. Ac. Nat. Sci. Phila., 1854, 153, Presidio, California.

*Leucosomus argyreiosus*, Günther, Cat., vii, 267, 1868.

*Leucosomus inæquilobus*, Günther, Cat., vii, 271, 1868.

*Pogonichthys macrolepidotus*, Jordan, Proc. U. S. Nat. Mus., 1880, 326; Jordan & Gilbert, Synopsis, 223, 1883.

*Symmetrurus argyreiosus*, Jordan & Gilbert, Synopsis, 222, 1883; young specimens, 4 inches long.

## 114. PTYCHOCHEILUS, Agassiz.

*Ptychocheilus*, Agassiz, Amer. Journ. Sci. Arts, 1855, 229, (*gracilis*).

Body elongate, little elevated, the caudal peduncle not contracted. Head long, slender, pike-like; mouth nearly horizontal, widely cleft, the maxillary extending to below the eye, the upper lip rather below the level of the eye; lower jaw included, both anteriorly and laterally; no barbel; lips thick. Scales small, little imbricated, mostly longer than deep. Lateral line decurved. Gill rakers very short. Dorsal fin well back, somewhat behind ventrals. Anal basis short. Caudal fin strong, its rudimentary rays not greatly developed. Intestinal canal short. Teeth 2, 5–4, 2; the straight limb of the pharyngeal bone extremely long and slender, its teeth wide apart, subconical, scarcely compressed, and but slightly curved at tip, the hook being turned in the direction of the angle of the bone; no trace of grinding surface. Fishes of very large size, reaching a length of more than 4 feet, the largest of the *Leuciscine Cyprinidæ*. With a general resemblance to *Leuciscus* and *Gila*, this genus differs strongly in the form of the pharyngeal bones and teeth. In this genus, as in *Gila*, the vertebræ are more numerous than usual in *Leuciscus*, 45 or 46 instead of 42 to 45. (*πτύξ*, fold; *χεῖλος*, lip; the skin of the mouth behind the jaws being folded.)

*a*. Scales of the lateral line 73 to 86, those before dorsal about 55. OREGONENSIS, 357.
*aa*. Scales in the lateral line about 90.
  *b*. Head 4 in length; cleft of mouth 3⅔ in head. HARFORDI, 358.
  *bb*. Head 3½ in length; cleft of mouth 3⅗ in head. LUCIUS, 359.

### 357. PTYCHOCHEILUS OREGONENSIS (Richardson).

(Squaw-fish; Chappaul; Sacramento Pike.)

Head 3¾; depth 4⅔ to 5; eye small, 7½ in head, 2½ in snout; snout 3. D. 10; A. 8; scales 9–73 to 86–7, 42 to 60 before the dorsal; teeth 2, 4–5, 2. Body comparatively robust, with stout caudal peduncle. Mouth large, the maxillary reaching front of pupil. Eye small, in young specimens proportionately much larger. Lateral line strongly decurved, much nearer belly than back. Coloration muddy greenish, with a few silvery scales; belly silvery; the fins, in spring, with red or orange; scales dusted with dark dots; young with black caudal spot. Length 2 to 4 feet. Rivers from Vancouver Island south to the San Joaquin; abundant in Columbia

River, Fraser River, etc.; ascending the Columbia and tributaries as far as Missoula, Montana, and the Great Shoshone Falls in the Snake, (Evermann), also everywhere in the Sacramento, San Joaquin, Salinas, and other lowland rivers of California. Common; used as food.

*Cyprinus (Leuciscus) oregonensis*, Richardson, Fauna Bor.-Amer., III, 305, 1836, Columbia River.
*Gila grandis*, Ayres, Proc. Ac. Nat. Sci. Cal., 1854, 18, San Francisco.
*Ptychocheilus major*, Agassiz, Amer. Journ. Sci. Arts, 1855, 229, San Francisco.
*Ptychocheilus gracilis*, Agassiz, Amer. Journ. Sci. Arts, 1855, 229, Willamette Falls.
*Ptychocheilus oregonensis*, Girard, Pac. R. R. Surv., 298, 1858; Jordan & Gilbert, Synopsis, 236, 1883; Evermann, Bull. U. S. Fish Comm., XI, 1891, 43, pl. 19, fig. 3.
*Ptychocheilus rapax*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 209, Monterey, California. (Coll. Trowbridge.) Large specimens with deep body (depth 4⅔) and scales before dorsal crowded, 49 in number Girard, Pac. R. R. Surv., X, 300, 1858; Jordan & Gilbert, Synopsis, 226, 1883.
*Leuciscus oregonensis*, Günther, Cat., VII, 239, 1868.
*Ptychocheilus grandis*, Girard, Pac. R. R. Surv., X, 300, 1858.
*Leuciscus grandis*, Günther, Cat., VII, 239, 1868; in part; perhaps mixed with *P. harfordi*.

### 358. PTYCHOCHEILUS HARFORDI, Jordan & Gilbert.

Head 4; depth 5¾. D. 8; A. 7; scales 17–90 to 95–9; teeth 2, 5–4, 2. Form of *P. oregonensis*, but more slender, the lateral line similarly much decurved, but scales smaller. Caudal less deeply forked; pectoral longer, reaching ⅗ distance to ventrals. Maxillary 2⅔ in head, reaching just past front of eye. Length 18 inches or more. Lower Sacramento River, with *P. oregonensis*, but much less common in the markets; possibly only the extreme variation of that species. (Named for W. G. W. Harford, curator of the museum of the California Academy of Sciences, now of the University of California.)

*Ptychochilus harfordi*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1881, 72, Sacramento River. (Type, No. 27246. Coll. Jordan & Gilbert.) Jordan & Gilbert, Synopsis, 226, 1883.

### 359. PTYCHOCHEILUS LUCIUS, Girard.

("White Salmon" of the Colorado.)

Head 3½; depth 5½; eye small, 2¼ in snout, 7 in head. D. 9; A. 9; lateral line 83 to 87; teeth 2, 4–5, 2. Vertebræ 45 or 46. Body slender, elongate, with long, slender, depressed head; the form and general appearance being that of *P. oregonensis*. Maxillary reaching past anterior margin of the eye, 2⅗ in head. Lateral line very strongly decurved. Fins moderate. Scales very small. Coloration plain, darker above, the young always with a black caudal spot and with a faint pale lateral band below a darker one. Length 5 feet. Colorado basin, very abundant in the river channels as far north as the base of the Rocky Mountains in Colorado. (Uncompahgre River at Delta.) The largest of the American *Cyprinidæ*, reaching a weight of 80 pounds, and having considerable value as a food-fish. Known locally as "*Salmon.*" (*lucius*, pike.)

*Ptychocheilus lucius*, Girard, Proc. Ac. Nat. Sci. Phil., 1856, 209, Rio Colorado. (Coll. A. Schott.) Mex. Bound. Surv., Ichth., 65, 1859; Jordan & Gilbert, Synopsis, 227, 1883.

### 115. GILA,* Baird & Girard.

*Gila*, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1853, 368, (*robusta*).

Body elongate, little compressed, the back arched, especially in the adult; the caudal peduncle typically extremely long, slender, contracted, much narrower than the base of the caudal fin, which is widely forked, with its basal fulcra very much developed. Head in typical species broad, depressed, its profile concave. Mouth large, horizontal, and overlapped by the broad snout. Dorsal fin behind the middle of the body, slightly behind ventrals. Anal basis short. Intestinal canal short. Scales very small, little imbricated, sometimes scarcely imbricate at all, longer than deep, especially posteriorly. No barbel. Pseudobranchiæ present. Teeth 2, 5–4, 2, close set, compressed and hooked, without grinding surface. Vertebræ 42 to 46. Peritoneum dusky. Species of large size, the typical form remarkably unlike the usual Cyprinoid type, but varying through a series of intermediate forms directly into *Leuciscus*, so that the genus has no very satisfactory technical character. (*Gila*, the name of the river where the typical species was first obtained.)

*a.* Belly more or less fully scaled.
  *b.* Caudal peduncle very slender, its least depth 1⅔ in maxillary; scales of back and belly much reduced. ELEGANS, 360.
  *bb.* Caudal peduncle not very slender, its least depth 1¼ in maxillary; scales of back and belly moderately reduced. ROBUSTA, 361.
*aa.* Belly naked; caudal peduncle slender; anterior profile scarcely concave. SEMINUDA, 362.

### 360. GILA ELEGANS, Baird & Girard.

(Bony-tail; "Gila Trout.")

Head 5; depth 5; eye 5. D. 9; A. 10; scales 23–85–10; teeth 2, 4–5, 2. The extreme species of this type. Body elongate, somewhat compressed, the region before the dorsal elevated, forming a sort of hump, the dorsal fin inserted on the downward slope of the back, so that its base is quite oblique. Caudal peduncle extremely long and slender, as broad as deep, and nearly terete, its length (from end of anal to middle of base of caudal) 1½ times the length of the head, its least depth 1⅔ in maxillary; its extremity dilated and compressed. Head short, broad, the snout depressed and broadly rounded; the anterior part of the head from behind the eyes broad and depressed; the posterior part high so that the profile forms a concave arc. All these traits of form more marked in old examples; young specimens (*emorii*) having the anterior profile scarcely concave. Mouth rather larger than in *G. robusta*, nearly horizontal, the upper lip on the level of the lower part of orbit, the maxillary extending to the front of orbit, the lower jaw on all sides included; skin

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*"The food of *Gila elegans* consists almost entirely of Gasteropods and caddis worms, which they crush with their powerful pharyngeals. The young differ greatly from the old, the cranium probably not becoming depressed until the second year. They are very tenacious of life. They have revived after being several hours out of the water and having become perfectly dry and stiff. They take the hook freely." (W. L. Carpenter, in Kirsch, Proc. U. S. Nat. Mus., 1888, 558.)

of the lower jaw hard. Eye small, anterior, placed low. Isthmus narrow. Gill rakers rather weak. Fins all long and falcate, larger than in *G. robusta.* Pectorals reaching ventrals; caudal fin deeply forked, its lobes long and pointed, the upper somewhat the longer; the rudimental basal rays strong, about 12 in number on each side. Scales scarcely imbricated at all, those on the caudal peduncle hardly touching each other, on the sides of the body much longer than deep; their texture thin and membranaceous; scales on back and belly much smaller than on sides and smaller than in other species, those on middle line of back obsolete or nearly so. Coloration bluish above, pale below. Length 12 inches. Colorado and Gila rivers, abundant in the channels, but not ascending so far as *G. robusta.* (*elegans*, elegant.)

*Gila elegans*, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1853, 369, Zuñi, Colorado, and Gila rivers. (Type, Nos. 935 and 20265. Coll. Maj. Thomas.) Girard, Pac. R. R. Surv., x, 286, 1858; Jordan & Gilbert, Synopsis, 227, 1883; Jordan, Bull. U. S. Fish Comm., ix, 1889, 27; Kirsch, Proc. U. S. Nat. Mus., 1888, 558.

*Gila emoryi*, Baird & Girard, Proc. Ac. Nat. Sci. Phil., 1853, 388, Gila River. (Type, No. 247. Coll. John Le Conte.) Jordan & Gilbert, synopsis, 229, 1883.

*Leuciscus elegans*, Günther, Cat., vii, 241, 1868.

*Leuciscus emorii*, Günther, Cat., vii, 242, 1868.

### 361. GILA ROBUSTA, Baird & Girard.

(Round-tail.)

Head 4; depth 5; eye 5 to 8. D. 9; A. 9; scales 17–80–10; teeth 2, 5–4, 2. Body elongate, the back elevated and the head depressed as in *Gila elegans*, but the caudal peduncle notably stouter, its least depth about one-third its length, 3¾ in length of head and 1¼ in maxillary; young with the head less depressed and the profile scarcely concave. Mouth large, the upper lip on the level of lower part of orbit. Fins rather lower than in *G. elegans*, the pectorals in the male reaching ventrals, but falling short in the female. Eye small, low, anterior. Lateral line much decurved. Coloration plain; males in life with lower fins and lower side of head red, and a vertical red dash on cheeks. Length 16 inches. Tributaries of the Rio Colorado and Rio Gila, very common up to the foot of the mountains in Colorado (Uncompahgre River at Delta); the flesh full of small bones and nearly worthless as food. (*robustus*, stout.)

*Gila robusta*, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1853, 368, Zuñi River. (Type, Nos. 276 and 277. Coll. Woodhouse.) Girard, Pac. R. R. Surv., x, 285, 1858; Jordan & Gilbert, Synopsis, 228, 1883; Jordan, Bull. U. S. Fish Comm., ix, 1889, 27.

*Gila gracilis*, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1853, 369, Zuñi River. (Type, No. 245. Coll. Capt. Sitgreaves.) Girard, Pac. R. R. Surv., x, 287, 1858; Jordan & Gilbert, Synopsis, 229, 1883.

*Gila grahami*, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1853, 389, Rio San Pedro, tributary to Rio Gila. (Type, No. 252. Coll. Clark.) Girard, U. S. & Mex. Bound. Surv., Ichth., 61, 1859; Jordan & Gilbert, Synopsis, 228, 1883.

*Ptychocheilus vorax*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 209, and Pac. R. R. Surv., x, 301, 1858, locality unknown The type of "*vorax*," examined by us is a true *Gila.* (Coll. Kreuzfeld.)

*Leuciscus zunnensis*, Günther, Cat., vii, 241, 1868, Zuñi River; substitute for *gracilis*, preoccupied in *Lenciscus.*

*Gila affinis*, Abbott, Proc. Ac. Nat. Sci. Phila., 1860, 474; type erroneously ascribed to Kansas River. (Type, No. 21088, Coll. Abbott.) Jordan & Gilbert, Synopsis, 229, 1883.

*Gila nacrea*, Cope, Hayden's Geol. Surv. Wyom. for 1870, 441, 1872; tributary of Green River, Fort Bridger, Wyoming; young, perhaps, of *G. elegans*; Jordan & Gilbert, Synopsis, 230, 1883.

*Leuciscus robustus*, Günther, Cat., vii, 241, 1868.

*Leuciscus grahami*, Günther, Cat., vii, 242, 1868.

### 362. GILA SEMINUDA, Cope & Yarrow.

Head 5; depth 5¾; eye 4. D. 10; A. 10; scales 21–98–12; teeth 2, 5–4, 2. Body moderately deep, with slender and tapering caudal peduncle, the least depth of which is about one-third its length. Back little elevated, not arched in front of dorsal. Head small, transversely convex, its profile continuous with that of the back and not concave. Mouth rather small, oblique, terminal, upper lip opposite the middle of orbit, the maxillary not reaching line of orbit. Eye large, rather anterior, but not very low. Fins moderate. Dorsal slightly behind ventrals. Brownish above, lower fins pink. Length 6 inches. Rio Virgen, in Utah, (Cope). Not seen by us. This species forms a transition to *Leuciscus* and other normally formed *Cyprinidæ*. (*seminudus*, half naked.)

*Gila seminuda*, Cope & Yarrow, Zoöl. Wheeler's Expl. W. 100th Mer., v, 666, 1875, (1876), Rio Virgen. (Type, No. 16975. Coll. Yarrow.) Jordan & Gilbert, Synopsis, 230, 1883.

## 116. LEUCISCUS, Cuvier.

### (Dace.)

*Leuciscus*, (Klein) Cuvier, Règne Animal, Ed. I, 194, 1817, (*dobula*, *rutilus*, *leuciscus*, *alburnus*, and *phoxinus*).

*Phoxinus*, Rafinesque, Ich. Oh., 45, 1820. (No type stated; *phoxinus* understood.)

*Dobula*, Rafinesque, Ich. Oh., 45, 1820. (No type mentioned; *dobula* understood.)

*Leuciscus*, Rafinesque, *l. c.* 45. (No type mentioned; *leuciscus* understood.)

*Phoxinus*, Agassiz, Mém. Soc. Sci. Nat. Neufchâtel, 1835, 37, (*phoxinus*).

*Leuciscus*, Agassiz, Mém. Soc. Sci. Nat. Neufchâtel, 1835, 38, (*leuciscus*), (not *Leuciscus*, Heckel, and of Günther, which is *Rutilus* of Rafinesque, the type being *rutilus*).

*Squalius*, Bonaparte, Fauna Italica, 1837, ¶ 6, (*tyberinus*).

*Leuciscus*, Bonaparte, *l. c.*, (*argenteus* = *leuciscus*).

*Telestes*, Bonaparte, *l. c.*, (*muticellus*).

*Cephalus*, Bonaparte, Catol. Metod., 1846, 39, (*cephalus*; no diagnosis).

*Microlepis*, Bonaparte, *l. c.*, (*turskyi*; no diagnosis).

*Richardsonius*,* Girard, Proc. Ac. Nat. Sci. Phila., 1856, 201, (*balteatus*).

*Tigoma*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 205, (*pulchella*).

*Cheonda*, Girard, *l. c.*, 207, (*cooperi*).

*Siboma*, Girard, *l. c.*, 208, (*crassicauda*).

*Clinostomus*, Girard, *l. c.*, 211, (*elongatus*).

*Hemitremia*, Cope, Proc. Amer. Philos. Soc., 1870, 462, (*vittata*).

*Protoporus*, Cope, Hayden's Geol. Surv. Montana for 1871, 473, 1872, (*domninus*).

*Iotichthys*, Jordan & Evermann, new subgenus (*phlegethontis*).

Body oblong, compressed or robust, covered with moderate or small scales. Lateral line decurved, complete, or variously imperfect. Mouth usually large and terminal, the lips normal, without barbel. Teeth mostly 2, 5-4, 2, (in American species sometimes 1, 5–4, 2, or even by atrophy, 1, 4–4, 1),

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*The ventral carination, used in the Synopsis as the distinctive character of *Richardsonius*, has no real existence except in specimens shrunken by alcohol; the narrow belly is rounded in cross section, fully scaled over, and without keel.

usually 2, 5–5, 2 in the European type; hooked, with rather narrow grinding surface or none. Anal basis short or more or less elongate. Dorsal fin posterior, usually behind ventrals. Intestinal canal short. Size generally large, some species very small. A very large group, one of the largest current genera in ichthyology, represented by numerous species in the rivers of Europe, Asia, and North America. Most of our species have been poorly defined. As the species are extremely variable in form, the number of nominal ones has been very greatly multiplied. Much larger series of each form are necessary before the species can be properly discriminated. Individual irregularities in dentition are common in this genus.

The typical species of the genus, *Leuciscus leuciscus*, is the common Dace or Vandoise of Europe, and differs greatly from any of the American forms. The presence of various intermediate species, however, makes it impossible for us to draw any satisfactory line between the Dace (*Leuciscus*) on the one hand, and such extreme forms as the long-mouthed minnows (*Clinostomus*) on the other.

In the subgenus *Leuciscus* the pharyngeal teeth are 2, 5–5, 2, rarely varying to 3, 5–6, 2, and the scales are rather large (about 50 in lateral line), closely imbricated and along the sides distinctly silvery. The anal fin is also long, of 11 to 12 rays, and the lateral line complete. The genus *Squalius*, as understood by us, is strictly synonymous with *Leuciscus*. In southeastern Europe and western Asia *Leuciscus* is replaced by the subgenus *Telestes*, which has the teeth 2, 5–4, 2, the scales much smaller (70 to 80), and not silvery, the anal fin still remaining long, and the lateral line complete. The American species called *Tigoma* and *Cheonda* are very close to *Telestes*, from which they differ only in the less closely imbricated scales, most of them, but not all, having the short anal fin generally characteristic of American *Cyprinidæ*. *Tigoma* can not be generically separated from *Telestes*, though it may be a question whether either should be united to *Leuciscus*. *Cheonda* differs from *Tigoma* in having the long anal fin of *Leuciscus*. *Richardsonius* is simply an extreme form of *Cheonda*. *Siboma* is founded on a *Tigoma* with very deep body and the scales less loosely imbricated than usual. *Clinostomus* is a peculiar group of small, fine-scaled minnows, with the gape of the mouth larger than in any other *Cyprinidæ* whatever. The relationship of the species to those called *Richardsonius* is, however, very close. The type of *Phoxinus* differs from *Leuciscus* in its incomplete lateral line and very small scales. In the latter respect the subgenus *Hemitremia* forms a complete transition to *Leuciscus*, and some of its species (as *margarita*) have the lateral line scarcely defective. Considering all the known species, *Phoxinus* can not be separated from *Leuciscus*. It may even be necessary to merge *Rutilus* and its American representatives, *Leucus* and *Mylolencus*, in the same great group. (*Leuciscus*, old name of the Dace, from λευκός, white.)

I. Lateral line complete in the adult.
  a. Mouth moderate, terminal, or subinferior, the lower jaw included, or scarcely projecting; teeth normally 2, 4–5, 2; scales rather small.
    b. Anal basis short, its rays 7 or 8, rarely 9; fins low; males not brilliantly colored. SIBOMA, (a coined name without meaning*):

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*Like many other of Girard's generic names; drawn ostensibly from "words taken from the North American Indians as more euphonic than any I might have framed from the Greek."

*c.* Caudal peduncle very deep and compressed, its least depth nearly equal to depth of head; dorsal inserted above ventrals; scales comparatively large and well imbricated, about 56. CRASSICAUDA, 363.

**Tigoma**, (a coined name):

*cc.* Caudal peduncle not very stout, its least depth not ⅔ depth of head ; scales small, not closely imbricated ; dorsal usually inserted behind ventrals.

*d.* Scales of medium size, 50 to 75 in the lateral line ; young with the head more or less conical ; adults with the head flattened and the back elevated.

*e.* Species from the Sacramento Basin ; scales large, about 52. CONFORMIS, 364.

*ee.* Species from the great basins of Utah, Nevada, Idaho, and Oregon; scales rather large, 53 to 63.

*f.* Sides of body abruptly silvery from a line just above lateral line; scales 13–60–7. BICOLOR, 365.

*ff.* Sides of body scarcely silvery, the scales everywhere much dotted; head subconical; eye small; form extremely variable. LINEATUS, 366.

*eee.* Species from the basin of the Rio Grande; mouth large; head large; teeth extremely variable; scales 60 to 67. NIGRESCENS, 367.

*eeee.* Species from the basin of Rio Yaqui ; scales 62 ; body robust. PURPUREUS, 368.

*eeeee.* Species from the Gila basin ; head more blunt ; scales 73 to 75; body rather elongate. INTERMEDIUS, 369.

*dd.* Scales very small, 80 in the lateral line.

*g.* Head depressed above ; back elevated with age ; species of large size; from the Gila Basin. NIGER, 370.

*gg.* Head not depressed ; the back not elevated ; species of small size, from the Great Basin of Utah. ALICIÆ, 371.

*bb.* Anal basis long, of 9 to 22 rays, the fins all high ; body more or less compressed; head bluntish, with large eye ; scales moderate, not closely imbricated, 55 to 65 in lateral line.

**Cheonda**, (a coined name):

*h.* Anal rays 9 to 13, usually 11.

*i.* Coloration plain ; body not much compressed. COOPERI, 372.

*ii.* Coloration not plain ; sides with a dark lateral band, or with two dark bands ; the interspace and the belly bright red in spring males.

*j.* Body very deep, the depth 3 in length. HUMBOLDTI, 373.

*jj.* Body moderately elongate, the depth 4 to 4½ in length ; cheek with a silvery or golden crescent ; a pale streak from gill opening above eye.

*k.* Anal rays usually 9 or 10 ; two dark lateral stripes. EGREGIUS, 374.

*kk.* Anal rays usually 11 or 12 ; one dark lateral stripe, forking anteriorly. HYDROPHLOX, 375.

**Richardsonius**, (named for Sir John Richardson):

*hh.* Anal rays 14 to 22, usually 16 ; body much compressed ; a dark lateral stripe ; crescent on cheek very distinct. BALTEATUS, 376.

**Clinostomus**, (*κλίνω*, to incline ; *στόμα*, mouth):

*aa.* Mouth very wide, the lower jaw much projecting beyond upper ; upper lip on the level of the middle of the pupil ; maxillary reaching to below the pupil ; body elongate, compressed ; dorsal well back ; males with red pigment, often brilliantly colored.

*l.* Scales moderate, 50 to 55 in lateral line. VANDOISULUS, 377.

*ll.* Scales minute, 63 to 70 in lateral line. ELONGATUS, 378.

II. Lateral line more or less incomplete ; small species, the males usually brilliantly colored, the sides and belly red in spring.

**Phoxinus**, (*φοξῖνος*, minnow; from *φοξός*, tapering; the old name of the European "minnow," *Leuciscus phoxinus*):

*m.* Scales minute, 80 to 100 in a longitudinal series ; lateral line very short ; snout blunt. NEOGÆUS, 379.

**Hemitremia**, (*ἡμι-*, half; *τρῆμα*, aperture = lateral line):

*mm.* Scales moderate or large, 40 to 60 in a longitudinal series ; lateral line variously developed, sometimes almost complete.

*n.* Scales in a longitudinal series 52 to 60; lateral line well developed, nearly complete.
*o.* Snout short and very blunt; mouth small, not reaching orbit. MARGARITA, 380.
*oo.* Snout subconical; maxillary about reaching front of eye. ORCUTTI, 381.
*nn.* Scales in a longitudinal series 40 to 45; lateral line more or less developed.
*p.* Caudal with a distinct black spot. MILNERIANUS, 382.
*pp.* Caudal without distinct black spot. FLAMMEUS, 383.
IOTICHTHYS,, (*ἰῶτα*, the smallest letter; *ἰχθύς*, fish; from the small size.)
*mmm.* Scales in a longitudinal series about 36; no caudal spot; no trace of lateral line. PHLEGETHONTIS, 384.

### Subgenus SIBOMA, Girard.

### 363. LEUCISCUS CRASSICAUDA (Baird & Girard).

(SACRAMENTO CHUB.)

Head 4⅛; depth 3; eye 5. D. 8; A. 8; scales 9–56–7; teeth 2, 5–4, 2, usually without grinding surface. Body short, deep, compressed, the antedorsal region arched, the caudal peduncle nearly as deep as long, about as deep as the head. Head conic, the profile steep, the muzzle short and rather pointed. Mouth small, oblique, the jaws nearly equal; upper lip on the level of lower part of pupil; maxillary scarcely reaching front of eye; isthmus very narrow; preorbital nearly as deep as long. Eye small, anterior. Fins low. Dorsal fin opposite ventrals, nearer caudal than snout; caudal fin short, little forked, scarcely broader than the very deep caudal peduncle, the spines of the caudal vertebræ very strong. Scales large, rather closely imbricated, their exposed surfaces rather deeper than long; 26 scales before dorsal. Lateral line decurved. Color brownish; sides white; young spotted above; scales everywhere with dark dots; fins plain. Length 12 inches. Rivers of California; generally abundant in the Sacramento and San Joaquin. (*crassus*, fat; *cauda*, tail.)

*Leuciscus gibbosus*, AYRES, Daily Placer Times and Transcript, May 30, 1854, San Francisco, not of Storer, 1845.

*Lavinia crassicauda*, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 137, San Joaquin River.

*Tigoma crassa*,[*] GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 207, Sacramento River.

*Siboma crassicauda*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 208, and Pac. R. R. Surv., x, 296, 1858.

*Leuciscus crassicauda*, GÜNTHER, Cat., VII, 243, 1868.

*Squalius gibbosus*, JORDAN & GILBERT, Synopsis, 239, 1883.

*Squalius crassus*, JORDAN & GILBERT, Synopsis, 241, 1883.

### Subgenus TIGOMA, Girard.

### 364. LEUCISCUS CONFORMIS (Baird & Girard).

Head 3½; depth 3½; eye 5. D. 8; A. 8; scales 9–52–5. Body robust, rather elevated. Head moderate, the mouth rather small, oblique; maxillary not quite reaching eye. Eye moderate. Dorsal fin considerably behind ventrals. Scales large; lateral line decurved. Purplish brown above, yellowish below. Length 4 inches. Tulare Valley, California; only the types known; apparently close to *L. crassicauda*, but with larger scales; perhaps the young of the same species. (*conformis*, uniform.)

*Lavinia conformis*, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 137; Poso Creek, Tulare County, California. (Coll. Heermann.)

*Tigoma conformis*, GIRARD, Pac. R. R. Surv., x, 289, 1858.

*Squalius conformis*, JORDAN & GILBERT, Synopsis, 237, 1883.

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[*] Teeth with narrow grinding surface; scales 10–57–7; head 4; depth 3½, in Girard's type, which was 10 inches long. (Coll. Dr. J S. Newberry.)

### 365. LEUCISCUS BICOLOR* (Girard).

Head 3¾; depth 3¾; eye small, 6. D. 8; A. 8; scales 13–60–7; teeth 2, 5–5, 2. Body robust, heavy anteriorly, tapering backward. Head long, mouth large, the maxillary reaching eye. Lateral line decurved. Dorsal fin inserted almost directly over ventrals; fins rather small. Dusky above, sides and below silvery, the color contrasting with that of the back. Length 12 inches. Klamath Lake, Oregon. (*bicolor*, two-colored.)

*Tigoma bicolor*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 206, Klamath Lake, Oregon; and Pac. R. R. Surv., x, 289, 1858. (Type, No. 234. Coll. J. S. Newberry.)

*Cheonda cærulea*,† Girard, *l. c.*, 1856, 207, Lost River, Oregon. (Type, No. 237 (2790). Coll. J. S. Newberry.)

*Squalius cæruleus*, Cope, Proc. Ac. Nat. Sci. Phila., 1883, 146; Jordan & Gilber, Synopsis, 241, 1883.

*Squalius bicolor*, Jordan & Gilbert, Synopsis, 237, 1883.

### 366. LEUCISCUS LINEATUS (Girard).

(Great Chub. Chub of Utah Lake.)

Head 3½; depth 3½; eye 7. D. 9; A. 8; scales 10–55 to 63–5;‡ teeth 2,5–4,2, short and stout, one of them with grinding surface. Body robust, elevated anteriorly, the sides compressed, although the back is very broad. Head broad, the interorbital space flattish. Adult with the profile concave, the young with profile straight or convex. Snout broad, elevated at tip; premaxillary on level of pupil. Mouth very oblique, the mandible projecting; maxillary reaching front of eye. Eye small, anterior, 1¾ in snout. Isthmus very narrow. Scales large, subequal, broadly exposed, firm. Lateral line decurved. Dorsal nearly median, inserted directly over ventrals; caudal evenly forked, the peduncle long and deep. Pectorals short, extending three-fifths the distance to ventrals; ventrals about to vent. Lower fins short. Color blackish; everywhere dark; the scales much dotted and with darker edges, which often form lines along the rows of scales; males without red. Length 12 to 15 inches. One of the largest and most widely distributed species, found everywhere in the Great Basin of Utah, and also abundant in the Snake River Basin above the Shoshone Falls as far as the Yellowstone Park. Extremely destructive to other

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*Mr. Barton A. Bean, who has kindly reexamined the types of *Tigoma bicolor*, writes to us: "The types of *Tigoma bicolor* and *Siboma atraria* differ greatly in form, color, and somewhat in size of scales. *Atraria* is more robust than *bicolor*, its scales are larger, and its color quite distinct. The silvery color on the sides of *T. bicolor*, extends from considerably above the lateral line to all the lower parts. The scales of *bicolor* count 13–60–7, while in *S. atraria* of the same size they are but 11-52–53. In younger examples there arise a larger number of scales, the type of *atraria* having 11–55."

†*Leuciscus cæruleus*, (Girard). Head 3¾; depth 4¼. D. 9; A. 7; scales 13–61–7 in type; teeth 2, 5–5 2, with narrow grinding surface. Body slender, subfusiform. Head slender, the snout long, conical, rather flattened above. Jaws equal, the maxillary reaching to orbit. Dorsal fin inserted behind ventrals; anal fin quite small. Lateral line decurved. Dusky bluish above, pale below; scales everywhere with fine punctulations. Lost River, Oregon; certainly identical with *L. bicolor*. The original type has the head longer, the snout much longer and pointed, the mouth larger, the maxillary longer and less oblique, the eye somewhat larger, and the top of the head more flat than in *Leuciscus lineatus*.

‡Scales 12–63–7 is the most usual number in the Snake River Basin. The number seems to vary from 53 to 63.

fishes, especially to young trout. Varies greatly with age and surroundings. The present description is taken primarily from Utah Lake specimens, typical of *L. atrarius*. We have examined specimens from Utah Lake, Provo River, Bear River, Jordan River, Sevier River, Heart Lake, and Jackson Lake, Wyoming, and other streams tributary to Snake River.* (*lineatus*, streaked, a character usually not conspicuous, and produced by the paler centers of the scales contrasting with the dotted edges.)

*Tigoma lineata*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 206; locality unknown, type lost. (Coll. Beckwith.)

*Tigoma obesa*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 206, Salt Lake Valley; and Pac. R. R. Surv., x, 290, 1858; the name *obesus* preoccupied in *Leuciscus*. (Type, No. 2773. Coll. Bowman.)

*Siboma atraria*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 208, Utah District near the Desert, (Coll. Beckwith); and Pac. R. R. Surv., x, 297, 1858.

*Tigoma squamata*, Gill, Proc. Bost. Soc. Nat. Hist., 1861, 42; and Ichth. Capt. Simpson's Expl., 1876, 405, Salt Lake Basin; a very deep-bodied example; scales 10–50–3. (Type, No. 2607. Coll. C. S. McCarthy.)

*Protoporus domninus*, Cope, Hayden's Geol. Surv. Mont. for 1871, 473, 1872, Snake River, Fort Hall, Idaho, (Coll. Carrington); a very young example with incomplete lateral line and teeth 2, 4–4, 1; scales 9–56–6; Jordan & Gilbert, Synopsis, 203, 1883.

*Hybopsis bivittatus*, Cope, Hayden's Geol. Surv. Mont. for 1871, 1872, 474, Warm Springs, Utah, (Coll. Carrington); young with teeth 2, 4–4, 2; scales 12–53–11.

*Hybopsis timpanogensis*, Cope, Proc. Amer. Philos. Soc. Phila., 1874, 134, Timpanogos, Utah; young with incomplete lateral line; scales 13–52–2, and teeth 2, 4–4, 2. (Type, No. 15769. Coll. F. Klett); Cope & Yarrow, Zoöl. Wheeler Surv., 654, 1875.

*Siboma atraria*, and variety *longiceps*,† Cope, Zoöl. Wheeler Surv., 667, 1875, (1876), Snake Creek Valley, Nevada, near the Utah line, and near the Sevier Basin, belonging to the drainage of Lake Bonneville. (Type, Nos. 12910, 15770, 15782. Coll. Yarrow; C. G. Newberry.)

*Squalius rhomaleus*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1880, 461, very old; scales 10–55–5, Utah Lake. (Coll. Jordan.)

*Squalius cruoreus*, Jordan & Gilbert, *l. c.*, 460, 1880, Provo River; scales 11–56–6; young. (Type, No. 30806. Coll. Madsen.)

*Minnilus bivittatus*, Jordan & Gilbert, Synopsis, 195, 1883.

*Minnilus timpanogensis*, Jordan & Gilbert, Synopsis, 196, 1883.

*Squalius cruoreus* and *rhomaleus*, Jordan & Gilbert, Synopsis, 234, 240, 1883.

*Squalius lineatus*, Jordan & Gilbert, Synopsis, 236, 1883.

*Squalius obesus*, Jordan & Gilbert, Synopsis, 237, 1883.

*Squalius atrarius*, Jordan & Gilbert, Synopsis, 241, 1883; Jordan, Bull. U. S. Fish Comm., 1889, 33.

*Squalius squamatus*, Jordan & Gilbert, Synopsis, 241, 1883.

### 367. LEUCISCUS NIGRESCENS (Girard).

(Pescadito; Chub of the Rio Grande.)

Head $4\frac{1}{5}$; depth $4\frac{2}{5}$; eye about 6. D. 8; A. 8; scales 15–67 (60 to 67)–10; teeth 1, 4–4, 1, or 1, 4–5, 2, usually without grinding surface. Body rather slender, little compressed. Head rather long and pointed. Mouth moderate, oblique, terminal, the jaws about equal, the maxillary about reaching front of eye. Eye rather small. Scales moderate. Lateral line decurved. Fins large; dorsal behind ventrals, its tip when depressed reaching the posterior base of the anal; pectorals nearly reaching ventrals.

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*This species has been attributed to Lake Tahoe, apparently by error, *Rutilus olivaceus* having probably been mistaken for it.

†This variety is said to differ from the typical form in having the head longer and the scales larger. Scales 12–56–5.

Coloration dusky above; silvery below; males with the axil red; sides with a vague dusky band; young with a black caudal spot. Length 6 to 12 inches. Rio Grande Basin, from San Luis Park to Mexico, everywhere abundant in eddies and deep places in the river. Variable, the dentition especially so. The present description from specimens taken in the Rio Grande at Alamosa, corresponding to *L. pandora*; further south the species grows larger with the back higher, the head more depressed. Probably all are the same species. (*nigrescens*, blackish.)

*Gila pulchella*, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1854, 29, Rio Mimbres, Lake Guzman, Chihuahua; scales 66; teeth 2, 5–4, 2; not *Leuciscus pulchellus*, Storer. (Type, No. 233. Coll. Clark.)

*Tigoma nigrescens*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 207, Boca Grande and Rio Janos, Chihuahua. (Type, No. 219. Coll. Kennerly.)

*Tigoma pulchra*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 207, Chihuahua River: teeth 1, 4–4, 1, without grinding surface; scales 13–67–7; color bright. (Type, Nos. 227 and 228 (2782). Coll. Potts); Girard, U. S. Mex. Bound. Surv., Ichth., 65, 1859.

*Clinostomus pandora*, Cope, Hayden's Geol. Surv. Mont. for 1871, 475, 1872, Tributaries Rio Grande, Sangre de Cristo Pass; scales 17–59–10 to 18–65–11; teeth 1, 4–4, 1 to 2, 4–5, 2, with or without grinding surface. (Type, Nos. 15761, 15984, 15985, 15987, and 18000. Coll. Cope, Aiken, Yarrow.)

*Gila gula*, Cope, Zoöl. Wheeler's Expl. W. 100th Mer., v, 661, 1875, (1876), Rio de Acama, and near Fort Wingate, New Mexico; large specimens with the scales 16–60–11, and the mouth large; the teeth 2, 5–4, 2. (Type, No. 16979. Coll. Henshaw.)

*Cheonda modesta*, Garman, Bull. Mus. Comp. Zoöl., viii, 92, 1881, Rio Salinas, Saltillo, Coahuila; scales 14–65–9; head 3½; depth 3¾.

*Tigoma conspersa*,* Garman, Bull. Mus. Comp. Zoöl., viii, 92, 1881, Rio Nazas, Coahuila.

*Squalius pandora*, Jordan & Gilbert, Synopsis, 235, 1883.

*Squalius gula*, Jordan & Gilbert, Synopsis, 236, 1883.

*Squalius pulcher* and *pulchellus*, Jordan & Gilbert, Synopsis, 236, 238, 1883.

*Squalius conspersus*, Jordan & Gilbert, Synopsis, 239, 1883.

*Squalius nigrescens*, Jordan & Gilbert, Synopsis, 242, 1883; scales 16–70–10; teeth 2, 4, with grinding surface.

*Squalius modestus*, Jordan & Gilbert, Synopsis, 242, 1883.

### 368. LEUCISCUS PURPUREUS (Girard).

Head 3⅓; depth 3¾. A. 8; scales 13–62–8; teeth 1, 4–?, ?. Stout and compressed; head long. Lateral line decurved. Dorsal fin slightly behind ventrals. Fins all small. Blackish above, pale below. San Bernardino Creek in southern Arizona, a tributary of Rio Yaqui. Only known from Girard's type. It is not impossible that both *intermedius* and *nigrescens* may prove indistinguishable from *purpureus*, and very likely *niger* also may be the same. In view, however, of the general difference in the faunæ of the Rio Grande, Yaqui, and Gila, we admit the three species as distinct. (*purpureus*, purple.)

*Tigoma purpurea*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 206, San Bernardino Creek, Arizona. (Coll. Kennerly.)

*Squalius purpureus*, Jordan & Gilbert, Synopsis, 238, 1883.

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**Tigoma conspersa.* Form of *Leuciscus niger.*—Head 3¾; depth 3¾. D. 8; A. 8; "teeth 4, 1–1, 4, clawed;" scales 13–69–9. Profile of head concave, maxillary reaching front of orbit. Pectorals extending three-fourths distance to ventrals, which reach vent. Brown above; scales of back and sides speckled with darker; an obscure dusky lateral shade. Rio Nazas, Coahuila, a tributary of Laguna del Muerte.

### 369. LEUCISCUS INTERMEDIUS (Girard).

Head 3¾; depth 4. D. 8; A. 9; scales 15–73–9. Allied to *L. nigrescens*, but from a different river basin. Body elongate, heavy forward, the caudal peduncle slender. Head long, rather pointed, broad above, depressed over the eye; mouth large, oblique, the jaws equal, the maxillary just reaching eye. Fins moderate, the dorsal behind ventrals; pectorals long, nearly reaching ventrals. Color dusky everywhere, with dark dots, the sides soiled silvery; a plumbeous lateral streak; fins plain. Scales 75 in lateral line, in our specimen from Rio Santa Cruz at Tucson. Gila Basin. Very close to *L. purpureus*, but that species has apparently larger scales, and belongs to another river basin. (*intermedius*, intermediate—between *L. pulchellus* and *L. purpureus.*)

*Tigoma intermedia*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 206, Rio San Pedro of the Gila. Coloration silvery with dark dots; scales 15–73–9. (Type, No. 232. Coll. Clark.)

*Squalius lemmoni*,* ROSA SMITH, Proc. Cal. Ac. Sci., 1884, 3, Rillito Creek, near Tucson, Arizona. (Coll. J. G. Lemmon.)

*Squalius intermedius*, JORDAN & GILBERT, Synopsis, 238, 1883.

### 370. LEUCISCUS NIGER (Cope).

Head, 3¾; depth, 3¾; eye rather large, 5 in head. D. 8; A, 8; lateral line 80; teeth 2, 4–5, 2, said by Girard to have a developed grinding surface, which, however, we are unable to find. Body robust, the back elevated anteriorly, the caudal peduncle shortened and not very stout. Occiput depressed. Head large. Mouth large, moderately oblique, the lower jaw included, the maxillary extending to pupil. Fins small, the dorsal well backward. Scales small, posteriorly smaller and more crowded. Lateral line little decurved. Color dusky, the scales with black dots. Rio Gila. A large species, perhaps not distinct from *L. intermedius*, the scales apparently a little smaller, the differences in form no doubt due to age. (*niger*, black.)

*Gila gibbosa*, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 28, Rio Santa Cruz, Arizona; (the name *gibbosa* is twice preoccupied in *Leuciscus*). (Type, No. 222 (2775). (Coll. Clark; Heermann.)

*Tigoma gibbosa*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 207, and U. S. Mex. Bound. Surv., Ichth., 64, 1859.

*Gila nigra*, COPE, Zoöl. Wheeler's Expl. W. 100th Mer., v, 663, 1875, (1876), Ash Creek and San Carlos, Arizona; scales 78 to 87. (Type, No. 16972. Coll. Henshaw.)

*Squalius niger*, JORDAN & GILBERT, Synopsis, 239, 1883.

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*The following is the description published by Miss Smith (Mrs. Eigenmann):

*Squalius lemmoni*: Head 3½ (4⅓); depth 3⅝ (4⅘); length 5½ inches; D. 8; A. 8. Body not much compressed, but rather slender; the dorsal and ventral outlines about equally arched. Head subconical, little compressed, nearly as wide as deep, and flat on top; maxillary oblique, reaching front of eye, lower jaw barely included; diameter of eye not quite equal to snout, 1⅓ inch interorbital space, 4⅓ in head. Teeth 2, 5–4, 2, with evident grinding surface on three in the greater row. Pseudobranchiæ present. Isthmus narrow. Scales 68. Lateral line decurved, but not strongly. Scales largest on sides anteriorly; much smaller on dorsal and ventral surfaces. Scales not very firm, a few rubbed off from each of the four examples studied. Insertion of dorsal fin very slightly behind ventrals, nearer snout than base of caudal. Pectorals 1⅔ in head; ventrals 2 in head, very nearly reaching vent. Depth of caudal peduncle 2 in its length. Color generally smutty. Top of head, from tip of snout to occiput, evenly bluish black, sharply separating the head from the trunk; a median blackish streak from occiput to base of caudal, paler behind dorsal. A leaden band about as wide as eye from upper angle of opercle to base of caudal, running higher than the lateral line except at its posterior fourth, where it is upon the lateral line. Sides of head and body dusky from numerous dark punctulations. Below, plain white from chin to insertion of anal. Fins all dusky. Peritoneum blackish. Described from four specimens (the largest 5½ inches long) collected in Arizona by Mr. J. G. Lemmon, for whom the species is named. These specimens have been donated by the collector to the California Academy of Sciences. Mr. Lemmon states that he found these fishes in Rillito Creek, a small stream of the Santa Catalina Mountains, seven miles north of Tucson, Arizona, and that the largest ones caught were about ten inches in length.

### 371. LEUCISCUS ALICIÆ (Jouy).

(Leather-sided Minnow.)

Head 4¼; depth 3¾; eye 3½ to 4. D. 8; A. 8; scales about 19–80–12; teeth 2, 5–4, 2, typically without grinding surface, but subject to an unusual amount of irregularity, occasionally 2, 4–4, 1 or 2, and sometimes with grinding surface. Body comparatively elongate and compressed, the caudal peduncle long and rather slender. Head short, rather broad and flattish above, the interorbital space convex and broader than the eye. Eye moderate, as long as snout. Mouth rather small, low, terminal, oblique, the premaxillary just below level of pupil, the maxillary reaching to just beyond front of eye. Dorsal fin inserted somewhat behind ventrals. Pectorals short, not reaching nearly to ventrals, the latter not to vent. Scales very small. Lateral line somewhat decurved. Bluish olive above, with dark points; sides silvery, a dusky lateral shade; fins nearly plain; axils red in the males; coloration in spirits very pale, largely silvery. Length 6 inches. Great Basin of Utah; very abundant in the Bear, Provo, Jordan, and Sevier rivers; not known outside the limits of the old Lake Bonneville, except from Little Wood River, Idaho, where it has recently been found by Gilbert and Evermann, who found that the fauna of the Upper Snake River in Idaho is practically identical with that of Lake Bonneville. (Named for Mrs. Alice Jouy.)

*Tigoma gracilis*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 206, locality unknown, (Coll. Beckwith); the type lost; the name *gracilis* preoccupied in *Leuciscus*.

*Squalius copei*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1880, 461, Bear River, Evanston, Wyoming; Jordan & Gilbert, Synopsis, 238, 1883; not *Leuciscus copii*, Günther.

*Squalius aliciæ*, Jouy, Proc. U. S. Nat. Mus., 1881, 19, Provo River near Utah Lake. (Type, No. 27412. Coll. Jordan); Jordan & Gilbert, Synopsis, 238, 1883.

## Subgenus CHEONDA, Girard.

### 372. LEUCISCUS COOPERI (Girard).

Head 4⅓; depth 4¼; eye large, 4½ in head. D. 8; A. 11 or 12; lateral line 63. Body rather elongate, subfusiform, much compressed. Head moderate, the snout thickish, subconical, slightly projecting. Mouth oblique, the maxillary not quite reaching to eye. Fins large, the anal notably so. Dorsal somewhat behind ventrals. Coloration reddish gray; sides and belly silvery. Lower Columbia River. Known only from the original type, above described. (Named for Dr. John G. Cooper, of Oakland, one of the pioneer naturalists of California.)

*Cheonda cooperi*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 207, Fort Vancouver; and Pac. R. R. Surv., x, 294, 1858. (Type, No. 238. Coll. Dr. J. G. Cooper.)

*Leuciscus cooperi*, Günther, Cat., vii, 243, 1868.

*Squalius cooperi*, Jordan & Gilbert, Synopsis, 242, 1883.

### 373. LEUCISCUS HUMBOLDTI (Girard).

Head 4; depth 3; eye large, 4. D. 8; A. 12; scales 12–56–8; teeth 2, 4–5, 1. Body short and deep; head moderate; mouth terminal, oblique, the cleft rather short, the maxillary reaching front of eye. Lateral line moderately decurved. Dorsal fin rather behind ventrals; anal fin elongate. Color bluish; sides with two dusky lateral bands. Humboldt

River, Nevada; perhaps identical with *L. egregius*, but the type specimen is much deeper than any *egregius* we have seen. (Named for Alexander von Humboldt.)

*Tigoma humboldti*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 206, Humboldt River, Nevada; and Pac. R. R. Surv., x, 291, 1858. (Type, Nos. 225, 226. Coll. Bowman; Beckwith.)
*Squalius humboldti*, JORDAN & GILBERT, Synopsis, 234, 1883.

### 374. LEUCISCUS EGREGIUS (Girard).

Head 3⅔ to 4¼; depth 3⅘ to 4¼; eye 4¼. D. 8; A. 9; scales 12 or 13–52 to 56–6 to 8. Teeth 2, 4–5, 2, without grinding surface. Eye large. Body rather robust, compressed. Mouth oblique, the jaws equal, the maxillary about reaching front of eye. Fins all high, the anal shorter than in *L. hydrophlox*. Back blackish, with a broad blackish vertebral streak; usually two parallel dark bands along anterior third of sides, separated by a light streak one-half width of pupil. In life this light interspace is flushed with red. Posteriorly the two dark bands merge into a single median one on caudal peduncle and the lower is sometimes wanting; belly golden, with some red in males. A broad red streak nearly as wide as orbit bordering the dark lateral streak and extending to opposite front of anal. Top of head, snout, chin, and an irregular band behind eye blackish; axil scarlet; a golden crescent on cheek; fins unmarked. Length 3½ inches. Nevada to northern California, known from the Humboldt and Truckee basins and from Napa Valley; extremely common in Lake Tahoe and Truckee River. Here described from specimens from the Humboldt River at Winnemucca, sent by Frank Germain. These have been compared with tho type of *L. clevelandi*, which seems to be identical with them. This species may ultimately stand as *Leuciscus humboldti*. (*egregius*, surprising.)

*Tigoma egregia*, GIRARD, Pac. R. R. Surv., x, 291, 1858, locality unknown, but probably Great Basin of Nevada, the drainage of Lake Lahontan. (Coll. Kreuzfeld.)
*Gila ardesiaca*,[*] COPE, Zoöl. Wheeler Surv., v, 660, pl. xxx, figs. 1, 1*a*, 1875, (1876), locality unknown, probably Nevada. (Type, No. 16974. Coll. Yarrow & Henshaw.)
*Squalius galtiæ*,[†] COPE, Proc. Ac. Nat. Sci. Phila., 1883, 148, Pyramid Lake, Nevada.
*Phoxinus clevelandi*,[‡] C. H. and R. S. EIGENMANN, West American Scientist, 1889, 149, Ætna Springs, Napa County, California.
*Squalius ardesiacus*, JORDAN & GILBERT, Synopsis, 235, 1883.
*Squalius egregius*, JORDAN & GILBERT, Synopsis, 236, 1883.

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[*] *Gila ardesiaca*, COPE. Head 3½; depth 4⅕; eye 4. D. 8; A. 8. Scales 17–63–8. Teeth 2, 5–4, 2. Body rather stout, compressed; head heavy, muzzle short; mouth short, very oblique, the jaws about equal, the maxillary reaching past front of the large eye. Pectoral fin long, nearly reaching ventrals. Olivaceous above, a narrow plumbeous lateral band concurrent with the back.

[†] *Squalius galtiæ*, COPE. Head 4; depth 4¼; eye 3 in head. D. 8; A. (probably) 8. Scales 12–60–5. Teeth 1, 4–5, 1, without grinding surface. Dorsal inserted a little behind front of ventrals; muzzle short; mouth oblique, without prominent chin, the end of the maxillary reaching a little beyond front of orbit. Interorbital region gently and regularly convex, as wide as eye. Olive above, as far as a plumbeous band, which extends from the operculum to base of caudal; below this line, sides and belly silvery, except a broad band of crimson from the gill opening to front of anal; side of head with a dusky band. Pyramid Lake, Nevada; abundant.

[‡] *Phoxinus clevelandi*, EIGENMANN & EIGENMANN, Head 4¼; depth 4¼; eye 4¼. D. 9; A. 9 or 10. Scales 10–59–6. Teeth 2, 4–5, 2. Mouth oblique; jaws equal; maxillary reaching front of eye or slightly beyond; eye 1½ in interorbital space; pectorals reaching ventrals in males, shorter in females. Dark brown above, bordered by a darker stripe; a black band from tip of snout to base of caudal, a pale band between this and dark of back; fins mostly dusky. Length 4 inches. Æt Springs, Napa County, California. One of the types received from Dr. Eigenmann seems to agree fully with *L. egregius*. In general, however, the fauna of the Sacramento Valley has little in common with that of the Lake Lahontan drainage to which the Humboltd and Trucrikee vers belong.

### 375. LEUCISCUS HYDROPHLOX (Cope).

(SILVER-SIDED MINNOW; "PO-HE-WA.")

Head 4⅓; depth 4; eye large, 3⅕ to 3½ in head, equal to interorbital space. D. 9; A. 10 to 13, usually 10 or 11. Scales 12–58–5. Body rather elongate, but deep and compressed, formed as in the section *Clinostomus*. Head rather small, short, compressed, but broad above, the jaws equal. Mouth oblique, short, the maxillary reaching front of orbit, the upper lip opposite middle of orbit. Snout decurved and rather obtuse. Lateral line decurved; 33 scales in front of dorsal fin. Coloration greenish silvery; the back dusky; a dark blue or blackish lateral band between 2 silvery stripes; the lateral band and below bright orange-red in the males, the red usually ceasing at front of anal; a bright silvery or golden crescent on cheeks; a golden streak from snout above eye to gill opening; specimens in alkaline waters are very pale. Length 3 to 5 inches. Salt Lake Basin; excessively abundant in Provo River, Jordan River, and other clear streams; also recorded from the Snake River at Idaho Falls and elsewhere in its upper waters as far as Heart Lake, Wyoming; the fish fauna of this region being mostly identical with that of Lake Bonneville, which was once tributary to Snake River. The species bears some resemblance to *Notropis coccogenis* in form, color, and habits. Our description is drawn primarily from specimens from Provo River, typical of *L. tænia*. *L. montanus* is exactly the same, but *L. hydrophlox* may prove to have slenderer head and smaller eye. (*ὕδωρ*, water; *φλώξ*, flame.)

*Clinostomus hydrophlox*, COPE, Hayden's Geol. Surv. Mont. for 1871, 475, 1872, **Blackfoot Creek, Idaho.**

*Clinostomus montanus*, COPE, *l. c.*, 476, **Grass Creek, Idaho**; COPE, Proc. Ac. Nat. Sci. Phila., 1874, 136. (Type, Nos. 15771, 15772, and 12908. Coll. Yarrow.)

*Clinostomus tænia*, COPE, Proc. Amer. Philos. Soc. Phila., 1874, 133, **Utah Lake, Provo, Utah.** (Type, No. 16935. Coll. Yarrow.)

*Gila montana*, COPE, Zoöl. Wheeler Surv., v, 657, 1875, (1876).

*Squalius hydrophlox*, *tænia*, and *montanus*, JORDAN & GILBERT, Synopsis, 234, 1883.

*Leuciscus montanus*, JORDAN, Bull. U. S. Fish Comm., IX, 1889, 32.

*Leuciscus hydrophlox*, JORDAN, *l. c.*, 48.

## Subgenus RICHARDSONIUS, Girard.

### 376. LEUCISCUS BALTEATUS (Richardson).

Head 4½; depth 3¼; eye 3½. D. 10; A. 11 to 22, usually 16; vertebræ 40. Scales 13–55 to 63–6; teeth 2, 5–4, 2, without grinding surface. Body strongly compressed and somewhat elevated. Head small, the snout rather short and conical. Mouth terminal, oblique, the lower jaw slightly projecting. Gill rakers very small. Eye large. Anal and caudal large. Dorsal low, much behind ventrals. Base of anal 4¼ in length. Coloration plain, the sides bright silvery, usually with a dark lateral band; sides and belly silvery; cheek with a silvery crescent; a pale streak above eye and opercle, crimson in males in spring. Length 4 to 6 inches. Columbia River and streams about Puget Sound; generally abundant everywhere in the Columbia Basin, and very variable; the specimens from any single locality usually alike but different localities showing large variations. Also recorded (as *L. gilli*) from the headwaters of Clark's Fork of the Columbia. (*balteatus*, girdled.)

*Cyprinus* (*Abramis*) *balteatus*, RICHARDSON, Fauna Bor.-Amer., III, 301, 1836, Columbia River.

*Richardsonius lateralis*,* GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 202, Fort Steilacoom, Washington, (Type, No. 64. Coll. Suckley); and Pac. R. R. Surv., x, 279, 1858; JORDAN & GILBERT, Synopsis, 251, 1883.

*Leuciscus gilli*,† EVERMANN, Bull. U. S. Fish Comm., XI, 1891, 44, Browns Gulch Creek, Silver Bow, Montana. (Type No. 43953. Coll. Evermann & Jenkins.)

*Richardsonius balteatus*, GIRARD, Pac. R. R. Surv., x, 278, 1858; JORDAN & GILBERT, Synopsis, 251, 1883.

*Abramis balteatus*, GÜNTHER, Cat., VII, 309, 1868.

*Abramis lateralis*, GÜNTHER, Cat., VII, 309, 1868.

*Leuciscus balteatus* and *Leuciscus balteatus lateralis*, EIGENMANN, Bull. U. S. Fish Comm., XIV, 1894, 112 & 113.

*Leuciscus balteatus*, GILBERT & EVERMANN, Investigations Columbia River Basin, 46, 1894.

### Subgenus CLINOSTOMUS, Girard.

### 377. LEUCISCUS VANDOISULUS, Cuvier & Valenciennes.

Head 3⅔; depth 3⅔ to 4¼, the largest specimens most elongate, the females deeper; eye moderate, 3½. D. 9; A. 8; lateral line 48 to 53; teeth 2, 5–5, or 4, 2. Body oblong, deep, and compressed. Head rather large. Mouth large, oblique, the lower jaw projecting, the mandible extending to the pupil. Lateral line decurved. Color bluish green; some of the scales of the back irregularly darker, producing a mottled appearance; a dark lateral band with a pale streak above it in the adult; young nearly plain; males in spring with the region behind the head and above the pectorals as far back as the anal of a bright rose-red, brightest anteriorly. Length 5 inches. Streams about Chesapeake bay to Georgia; abundant in the clear, swift brooks east of the Alleghany Mountains; also (as *L. estor*) in tributaries of the Tennessee and Cumberland, west of the mountains. (*vandoise*, French name of the Dace, *Leuciscus leuciscus*.)

*Leuciscus vandoisulus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVII, 317, 1844, South Carolina; GÜNTHER, Cat., VII, 256, 1868.

*Clinostomus affinis*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 212, James River, Virginia; (Coll. Baird); COPE, Journ. Ac. Nat. Sci. Phila., 1868, 228.

*Clinostomus funduloides*, (Potomac River at Washington) and *carolinus*, (Salem, N. C.), GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 212; COPE, Cypr. Penn., 376, 1866.

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*The following characters are assigned to the form called *lateralis*: Body slenderer and less compressed than in *R. balteatus*. Mouth moderate, terminal, oblique; jaws equal. Anal base 5⅓ in length. Blackish above; a dark lateral band; the interspace and belly pale, crimson in males in summer. Head 4⅓; depth 3¾ to 4. D. 10; A. 14: scales 13–55–6; teeth 2, 5–5, 2. Columbia River and streams about Puget Sound. It apparently fully intergrades with the preceding, the anal rays ranging from 11 to 22. The name *Leuciscus lateralis* is preoccupied, and this form, if distinct, should stand as *Leuciscus gilli*.

†The types of *Leuciscus gilli* are described as follows: Head 4; depth 3½ to 3¾. D. 10; A. 14 (13 to 16). Teeth 2, 4–5, 2. Scales 11–66–7, 32 before dorsal. Body deep, compressed, much deeper than in *L. montanus*, the top of head broader, the eye and mouth smaller; eye 3½ to 4 in head, 1½ in interorbital space; maxillary not quite to front of orbit; snout short and blunt, 3¾ in head; lower jaw scarcely projecting; mouth oblique; caudal peduncle long. Dorsal small, anal large; caudal large; dark above, a dark lateral band with a yellowish band above it; belly reddish or orange; cheek with a bright yellow crescent; body and fins with black specks; a yellow blotch at base of pectoral. Length 4¼ inches. Browns Gulch, Silver Bow, Montana, and Swan Lake, near Flathead Lake, (Columbia Basin). Apparently not distinct from *L. balteatus*.

*Gila estor*,[*] JORDAN & BRAYTON, Bull. U. S. Nat. Mus., XII, 66, 1878, Elk River, Estill Springs, Tennessee; Stone River, Murfreesboro, Tennessee.

*Leuciscus affinis*, GÜNTHER, Cat., VII, 257, 1868.

*Gila vandoisula*, JORDAN & BRAYTON, Bull. U. S. Nat. Mus., XII, 24, 1878.

*Leuciscus funduloides*, GÜNTHER, Cat., VII, 256, 1868.

*Squalius vandoisulus* and *funduloides*, JORDAN & GILBERT, Synopsis, 232, 233, 1883.

*Squalius estor*, JORDAN & GILBERT, Synopsis, 232, 1883.

### 378. LEUCISCUS ELONGATUS (Kirtland).

(RED-SIDED SHINER.)

Head 4; depth 5; eye about 4. D. 8; A. 9; scales 10–70–5; teeth 2, 4–5, 2. Body elongate, compressed; head long, rather pointed. Mouth very large, oblique; the lower jaw notably projecting, with a small knob at the symphysis beyond tip of upper jaw; upper lip on level of pupil; maxillary extending to middle of orbit; posterior angle of opercle acute. Eye moderate. Scales very small. Fins short and high, the dorsal somewhat behind ventrals. Lateral line decurved. Color dark bluish; the scales mottled with paler; sides with a broad black band; belly more or less silvery; the front half of the lateral band bright crimson in spring males; belly and lower fins more or less reddened; a dark vertebral band. Length 5 inches. Great Lakes and Upper Mississippi Valley, chiefly from Pennsylvania to Minnesota; common in clear streams northward only. (*elongatus*, lengthened.)

*Luxilus elongatus*, KIRTLAND, Rept. Zoöl. Ohio, 1836, 169, and in Bost. Journ. Nat. Hist., III, 339, 1841, Mahoning River, Trumbull County, Ohio, and Lake Erie, near Cleveland.

*Leuciscus productus*, STORER, Synopsis, Fishes N. A., 416, 1846, Wabash River.

*Squalius proriger*, COPE, Proc. Ac. Nat. Sci. Phila., 1864, 280, Michigan.

*Leuciscus elongatus*, CUVIER & VALENCIENNES, XVII, 494, 1844; GÜNTHER, Cat., VII, 245.

*Clinostomus elongatus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 212.

*Clinostomus proriger*, COPE, Cypr. Penn., 375, 1866.

*Leuciscus proriger*, GÜNTHER, Cat., VII, 245; sides more compressed and more silvery; lateral line 63; teeth 2, 4–5, 1.

*Squalius elongatus*, JORDAN & GILBERT, Synopsis, 232, 1883.

### Subgenus PHOXINUS, Rafinesque.

### 379. LEUCISCUS NEOGÆUS (Cope).

Head 4; depth 4¼; eye moderate, 3½ in head. D. 8; A. 8; scales 18–80–10; teeth 2, 4–5, 2. Body short and thick, little compressed, the back little elevated. Head very large and broad, the muzzle blunt, 3 in head. Mouth small, quite oblique, the lower jaw scarcely projecting; maxillary reaching to beyond front of orbit, 2⅘ in head; upper lip on level of middle of pupil. Fins moderate; dorsal well backward, much nearer caudal than snout, somewhat behind ventrals; pectorals long, 1⅙ in head. Scales very small, almost embedded in the skin, covering the body evenly. Lateral line decurved, very short, not extending to ventrals. Back and belly scaly. Color pale or dark; back plain dusky; a black band through snout and eye to caudal; above this a pale band; below this abruptly white; belly and lower fins crimson in spring males; pectorals dusky; no caudal spot. Length 3 inches. Mississippi Valley and neighboring waters; not common; the few specimens known, from Livingston County, Michigan; Baraboo River, Wisconsin; White River, Arkansas; and the Black Hills of South Dakota, (Cox Lake, Chicken Creek, etc). (νέος, new; γῆ, world; the species is closely allied to the European *Leuciscus phoxinus.*)

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[*] *Leuciscus estor*, (Jordan & Brayton): Head 3⅔; depth 4¼; eye 4. D. 8; A. 8; scales 8–50–5 teeth 2, 5–4, 2. Body elongate, compressed, the caudal peduncle rather long, but not so long as head. Head very long and large, flattish, but not broad above. Mouth larger than in any other of our *Cyprinidæ*, very oblique, the upper jaw on the level of the pupil, the maxillaries extending to opposite middle of orbit; length of gape a little more than half length of head; lower jaw considerably the longer. Eye rather large, less than snout. Scales moderate. Lateral line strongly decurved; 23 scales in front of dorsal fin; fins high. Color dark olive above, many scales irregularly darker; sides silvery; no dark lateral band; a broad shade of deep rose color along the sides in spring males, below which most of the belly is bright crimson, these red colors brightest anteriorly; a narrow dark lateral streak like a pencil mark, from head to tail, overlaid by the scales. Length 4 inches. Cumberland and Tennessee rivers; in clear brooks; not very common. Perhaps a distinct species, but we are unable to find constant characters for distinction. (Type, No. 31147. Coll. Jordan & Brayton.)

*Phoxinus neogæus*, Cope, Cypr. Penn., 375, 1866, New Hudson, Livingston County, Michigan; Jordan & Gilbert, Synopsis, 243, 1883.

*Leuciscus neogæus*, Günther, Cat., vii, 247, 1868; Evremann & Cox, Bull. U. S. Fish Comm., xv, 1895.

### 380. LEUCISCUS MARGARITA (Cope).

Head 4; depth 4¼. D. 8; A. 9; scales 11–52 to 58–8; teeth 2, 5–4, 2. Body stout and thick, little compressed, the back somewhat elevated. Caudal peduncle thick. Head blunt, thick, and rounded. Mouth small, terminal, oblique, the upper lip below the orbit; eye rather large; scales rather small. Lateral line decurved, more or less incomplete, the pores usually ceasing behind middle of body. Fins rather large. Dorsal fin posterior. Coloration above dusky olive, dusted with dark specks; sides plumbeous silvery, forming a narrow streak on tail; belly white, crimson in spring males; snout dusky; fins plain; scales punctate. Length 3 inches. Susquehanna River to James River; not common; also taken in the head waters of the Kanawha. A handsome little fish, quite unlike most other American species, resembling most *Leuciscus neogæus.* (*margarita*, μαργαρίτης, a pearl.)

*Clinostomus margarita*, Cope, Cypr. Penn., 377, 1866, Conestoga River, Lancaster, Pennsylvania.

*Phoxinus margaritus*,[*] var., Jordan, Bull. U. S. Fish Comm., viii, 1888, 141, Reed Creek, Wytheville, Virginia. (Coll. Jordan, Evermann & Jenkins.)

*Leuciscus margarita*, Günther, Cat., vii, 246, 1868.

*Squalius margaritus*, Jordan & Gilbert, Synopsis, 235, 1883.

### 381. LEUCISCUS ORCUTTI (Eigenmann & Eigenmann).

Head 3½ to 4; depth 3½ to 4½; eye moderate, 4⅘ in adult, 1½ in interorbital width. D. 8; A. 7; scales 58; teeth 2, 5–4, 1; hooked, their tips black in the adult. Body moderately compressed; head subconical; maxillary scarcely reaching front of eye. Lateral line little decurved, more or less incomplete, usually extending to caudal peduncle. Dorsal inserted slightly behind ventrals. Peritoneum black; intestine a little longer than body. Dark gray, often a faint plumbeous lateral band. Rivers of Southern California tributary to the Pacific, abundant; described from Temecula River; also found in the Rio San Luis Rey and Rio San Jacinto, (Edward Hyatt), and Santa Ana River, (Gilbert). (Named for Charles Russell Orcutt, the well known botanical collector who first obtained it.)

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[*] These specimens seem to belong to *L. margarita*, but they have the scales larger, 52 to 54 in lateral line, 28 before dorsal. Mouth very small, anterior; dorsal quite low, inserted behind ventrals. Color dark; a very distinct caudal spot, and a well-defined black lateral band. Head 4½; depth 4½. Length 2 inches. Reed Creek, head waters of Kanawha River, Wytheville, Virginia.

*Phoxinus orcutti*, EIGENMANN & EIGENMANN, Proc. Ac. Sci. Cal., 2d series, III, 1890, 2, Temecula River, Riverside County, California. (Type, No. 41925.)

### Subgenus HEMITREMIA, Cope.

### 382. LEUCISCUS MILNERIANUS (Cope).

Head 4; depth 5½; eye 3½. D. 8; A. 8; scales 8–40 to 45–7; teeth 2, 5–4, 2. Body elongate; chin slightly projecting. Scales in 15 longitudinal rows between dorsal and ventral. Orbit equal to length of muzzle. Dorsal inserted behind the entire base of ventrals. Mouth very large, maxillary extending nearly to pupil; head rather flat above. Length of lateral line unknown, the scales posteriorly having been lost in the type. Brownish olive above, below silvery; a black band, not well defined on the borders, extending from the end of the muzzle to the base of the caudal fin, where it ends in a black spot; a reddish spot at base of anterior dorsal rays; muzzle dark. Length 2½ inches. Upper Missouri River. (Cope.) Not seen by us. (Named for James W. Milner, then Asst. U. S. Fish Commissioner, author of important contributions to Economic Ichthyology.)

*Phoxinus milnerianus*, COPE, Amer. Nat., July, 1879, 440, upper Missouri River, probably Battle Creek, Montana; (Coll. Cope); JORDAN & GILBERT, Synopsis, 243, 1883.

### 383. LEUCISCUS FLAMMEUS (Jordan & Gilbert).

Head 4; depth 4; eye large, 3½ in head. D. 8; A. 8; scales 7–43–5; teeth 2, 4–5, 2. Body moderately stout, slenderer and more compressed than in *L. neogæus*. Head rather short and deep, the upper outline rounded, the muzzle rather blunt. Mouth small, oblique, the jaws about equal, the upper lip on level of pupil; maxillary extending to front of orbit. Scales much larger and more loosely imbricated than in *L. neogæus*; back and belly scaled. Lateral line short, decurved, on 14 scales, not reaching base of ventrals. Fins small, the dorsal well backward. Back dark; a black lateral band, formed of dark specks; above this a pale band; the belly below this pale; bright scarlet red in the males in spring; a small black spot at base of caudal. Length 2½ inches. In tributaries of Tennessee River, common in clear streams in northern Alabama. (*flammeus*, flaming.)

*Hemitremia vittata*, COPE, Proc. Am. Philos. Soc. Phila., 1870, 462, Holston River, Knoxville, Tennessee; JORDAN & GILBERT, Synopsis, 162, 1883; the name *vittatus* is preoccupied in *Leuciscus*.

*Phoxinus flammeus*, JORDAN & GILBERT, in Jordan, Man. Vert. E. U. S., ed. 2, 303, 1878, Elk, River, Estill Springs, Tennessee; JORDAN & BRAYTON, Bull. U. S. Nat. Mus., XII, 66 1878; JORDAN & GILBERT Synopsis, 243, 1883.

### Subgenus IOTICHTHYS, Jordan & Evermann.

### 384. LEUCISCUS PHLEGETHONTIS (Cope).

Head 3¾; depth 3⅓. D. 7; A. 8; scales 6–36–4, 17 before dorsal; teeth 1, 5–4, 2. Body short, deep, compressed. Mouth short, very oblique, the lower jaw projecting, the maxillary reaching front of eye, which is rather large. Dorsal behind ventrals; pectorals about reaching ventrals. Lateral line entirely wanting, not a pore developed in the many specimens examined. Olivaceous; a broad plumbeous lateral band; a dusky dorsal line; belly golden, probably red in spring males. Length 1½ inches. Tributaries of Great Salt Lake, and Sevier Lake (Basin of Lake Bonneville); excessively common in ponds and warm pools. One of the smallest of our fishes, and the most aberrant of those here referred to *Leuciscus*. (φλεγέθω, to flame.)

*Clinostomus phlegethontis*, Cope, Proc. Amer. Philos. Soc. Phila., 1874, 137, Beaver River, Utah. (Type, No. 16983. Coll. Yarrow & Henshaw.)

*Gila phlegethontis*, Cope, Zoöl. Wheeler's Expl. W. 100th Mer., v, 657, 1875, (1876).

*Phoxinus phlegethontis*, Jordan & Gilbert, Synopsis, 244, 1883; Jordan, Bull. U. S. Fish Comm., ix, 1889, 34.

## 117. RUTILUS, Rafinesque.

(Roaches.)

*Rutilus*, Rafinesque, Ich. Oh., 48, 50, 1820. (*rutilus*: no type indicated on page 48; on page 50, *rutilus** mentioned.)

*Leucos*, Heckel, Russegger's Reisen, 1, 1038, 1843, (*cisalpinus*). (Not *Leucus*, Kaup, a genus of Gulls.)

*Cenisophius*, Bonaparte, Católogo Metódico Pesci Eur., 1846, 29, (*pauperum*; no diagnosis).

*Gardonus*, Bonaparte, *l. c.*, (*decipiens*; no diagnosis).

*Pigus*, Bonaparte, *l. c.*, (*pigus*; no diagnosis).

*Pseudophoxinus*, Bleeker, Prodromus Cyprin., 1860, (*zeregi*).

?*Anchybopsis*, Cope, Proc. Amer. Philos. Soc. Phila., 1870, 543, (*latus*, a fossil species).

*Myloleucus*, Cope, Bull. Hayden's Geol. Surv. Montana for 1871, 475, 1872, (*pulverulentus*).

*Siphateles*, Cope, Proc. Ac. Nat. Sci. Phila., 1883, 146, (*vittatus*), young with lateral line imperfect.

Body stout, compressed. Mouth normal, oblique; no barbel. Teeth 4–5, or 5–5, or 6–5, hooked, with moderate grinding surface. Scales moderate or small. Lateral line continuous or incomplete, decurved. Anal basis short or rather long. Abdomen not compressed. Intestinal canal not elongate. Species numerous in Europe, Asia, and America. The American species are certainly closely allied to the European type of *Rutilus*, Rafinesque, (including *Leucos*, Heckel), differing in the presence of teeth 5–5 or 5–4, instead of 6–5 or 5–5, as most of the species of *Rutilus* have. The anal fin is long in *Rutilus*, of 10 to 14 rays as in *Leuciscus* proper, and as in European minnows generally, while in these American Roaches (*Myloleucus*) there are but 8 anal rays. But as this character has not generic value in *Leuciscus* and *Notropis*, it can not be admitted here.

As in the case of *Leuciscus*, the American forms are confined to the western waters. They are dusky in color, and have small, loosely-embedded scales which give an appearance unlike that of their relatives in Europe. As in the other case, Austrian and Asiatic species (subgenus *Pseudophoxinus*, Bleeker) seem to form connecting links. *Rutilus zeregi* has teeth 5–5, anal rays 9, and scales about 63. We are therefore unable to

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*"I call this genus *Rutilus*, in the supposition that the *Cyprinus rutilus* may be the type of it." (*Rafinesque*.)

draw any satisfactory line between *Rutilus* on the one extreme and *Myloleucus* at the other. The American species of this genus are very imperfectly known, and some of them are subject to large variations. (*rutilus*, ruddy, the ancient name of the European Roach or Rothauge, *Rutilus rutilus.*)

LEUCOS, (λευκός, white.):
- *a.* Teeth 5–5, never 4–5, nor 5–6; anal fin short, of about 8 rays; scales small, sexual differences slight, males with little or no red pigment.
  - *b.* Scales about 58 to 65 in the lateral line. Body slender, the depth 4 in length; color olive, the belly silvery. OLIVACEUS, 385.

MYLOLEUCUS, (μύλος, grinder; Leucos):
- *aa.* Teeth 4–5, with grinding surface; anal fin short, of about 8 rays; scales small. Dusky species, the scales sprinkled with dark dots. Sexual differences moderate, usually some red pigment in spring.
  - *c.* Scales in lateral line 45 to 67.
    - *d.* Scales 8–46 to 50–5; coloration paler and less dotted with black. BICOLOR, 386.
    - *dd.* Scales 10 to 14–50 to 67–5 to 7; coloration dusky, much dusted with dark specks. SYMMETRICUS, 387.
  - *cc.* Scales rather large, 39 in lateral line; about seven rows between lateral line and dorsal; sides with a plumbeous band and a black caudal spot. BOUCARDI, 388.

### Subgenus LEUCOS, Heckel.

### 385. RUTILUS OLIVACEUS (Cope).

Head 4; depth 4⅕ to 4⅓. D. 8; A. 8; scales 11–56–6; teeth always 5–5, with grinding surface. Body fusiform, compressed; head narrowed to the muzzle, the mouth opening very obliquely forwards and upwards; maxillary concealed in the closed mouth, its tip scarcely reaching front of eye. Eye 1⅓ in snout, 1⅗ in interorbital space, 5 in head; middle of front flat, its edges sloping to the superciliary border; pectoral long, reaching ⅔ distance to ventrals. Dusky olive, with brassy luster, the belly silvery; body and fins much dotted; no red or yellow; no lateral band; young with lateral line incomplete. Length 1 foot or more. Lake Tahoe, Pyramid Lake, and neighboring waters; excessively abundant; much resembles *Leuciscus lineatus* in appearance and habits; a greedy fish, destructive to young trout. (*olivaceus*, olive-colored.)

*Leucus olivaceus*, COPE, Proc. Ac. Nat. Sci. Phila., 1883, 145, Pyramid Lake, Nevada.
*Leucus dimidiatus*,* COPE, *l. c.*, 145, Pyramid Lake, Nevada.
*Siphateles vittatus*,† COPE, Proc. Ac. Nat. Sci. Phila., 1883, 146, Pyramid Lake, Nevada.

### Subgenus MYLOLEUCUS, Cope.

### 386. RUTILUS BICOLOR (Girard).

Head 4; depth 4½; eye 4½. D. 8; A. 7; scales 9–48–6; teeth 4–5. Body moderately stout. Head rather heavy, the muzzle short and conical. Mouth moderate, very oblique, the jaws equal, the maxillary reaching line of eye. Scales rather large. Lateral line decurved. Eye rather large. Color transparent olivaceous; a distinct plumbeous lateral band; fins

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*Eye equal to interorbital width, 3½ in head, a little more than length of muzzle. Mouth oblique, the maxillary reaching front of eye. Ventral a little behind front of dorsal. Light brown above, becoming plumbeous lower, the belly pure silver white. Head 4; depth 4½. A. 8. Scales 14–65–8. Teeth 5–5, with grinding surface. Length 4 inches. Pyramid Lake, Nevada; very abundant. (Cope.) Evidently the half-grown of *R. olivaceus*.

†Head 4; depth 4½; eye 3. D. 8; A. 8; scales 11–55–5; teeth 5–5, with well-developed grinding surface. Lateral line very imperfect. Eye a little less than interorbital width. Mouth oblique, the maxillary not quite reaching front of eye. Ventral fins beneath anterior part of dorsal. Brownish above, belly and sides silvery; a straight lateral band of lead color, interrupted at base of caudal by a vertical band of straw yellow, which has a dark posterior edge. Length 3 inches. Pyramid Lake, Nevada, evidently the young of *R. olivaceus*. (Cope.) (*vittatus*, striped.)

dusky shaded; scales with some brown dots, but not profusely dusted with black specks as in the preceding species. Length 8 inches. Lakes of southeastern Oregon (Klamath, Warner, Goose, etc.), the old Lake Idaho; locally abundant; not found in Lake Lahontan, Lake Bonneville, nor in the Sacramento Valley. Very distinct from *R. symmetricus*, the scales larger, the color less opaque. It is, however, close to *Rutilus olivaceus*, in appearance, but is more slender and has larger scales, besides the difference in the teeth. (*bicolor*, two-colored.)

*Algansea bicolor*,* GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 183, Klamath Lake. (Type, No. 2750. Coll. Dr. J. S. Newberry.)
? *Algansea antica*,† COPE, Proc. Ac. Nat. Sci. Phila., 1864, 282, "Texas;" JORDAN, Proc. U. S. Nat. Mus., 1885, 121.
*Myloleucus thalassinus*,‡ COPE, Proc. Ac. Nat. Sci. Phila., 1883, 143, Goose Lake, Oregon.
*Leuciscus bicolor*, GÜNTHER, Cat., VII, 245, 1868.
*Leucos bicolor*, JORDAN & HENSHAW, *l. c.*, 193, 1878.
*Leucus bicolor*, JORDAN & GILBERT, Synopsis, 246, 1883.
*Leucus anticus*, JORDAN & GILBERT, Synopsis, 246, 1883.

### 387. RUTILUS SYMMETRICUS (Baird & Girard).

Head 3¾; depth 4⅕; eye 3 to 4. D. 8; A. 8; scales 10 to 14–52 to 67–5, extremely variable, usually 53 to 56; teeth 5–4. Body rather elongate, moderately compressed, not elevated. Head short, rather slender; mouth small, little oblique, the lower jaw included. Eye large, anterior; snout usually a little convex, a little longer than eye; mouth not quite terminal. Lateral line strongly decurved. Dorsal distinctly behind ventrals. Coloration, dusky above, sides pale, scales more or less dotted with black; bright-colored specimens have a dark lateral band from snout to middle of caudal, a second dark band or series of spots below lateral line ceasing at vent; axils orange; cheeks silvery. Color much brighter in specimens from clear brooks (as Tres Pinos Creek, San Benito County, California). Length 5 inches. Rivers of California and Nevada, probably generally distributed. Originally known from the San Joaquin and Merced rivers and Kern Lake. It is also very common in streams of the coast ranges from San Francisco to Salinas River, being in the brooks of Santa Clara Valley the most abundant fish. Other specimens corresponding rather to *obesus* occur in streams tributary to Owen Lake, Mohave River, Washoe Lake, Truckee River, Humboldt River, etc., (the basin of the Quaternary Lake Lahontan.). Still other records are from western and northern Utah, in the Lake Bonneville basin. If three species are confounded under the name *symmetricus*, they are likely to be *symmetricus* (=*formosus*), from streams west of the Sierra Nevada, *obesus* from the basin

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*The following notes have been made on the types of *Algansea bicolor*: Length 7 inches; head 4, depth 4½; eye 4½ in head. Eye shorter than snout; snout pointed; maxillary not reaching eye. Lower jaw little projecting. D. 9; A. 8; scales 9–48–6. Scales larger than in types of *obesa*, from which it is distinct.

†A specimen from unknown locality has been described as *Algansea antica*, COPE: Head acute, subconic; snout rather pointed; insertion of dorsal midway between pupil and base of caudal. Mouth small, the jaws equal; maxillary 4 in head, not reaching orbit. Lateral line decurved. Caudal short, little forked; pectoral short, not reaching ventrals. Eye 5 in head. Purplish slate above, yellow below; sides of head and edges of scales punctulate. Head 3⅖; depth 3⅚; D. 8; A. 8; scales 10–49–6; teeth 4–5, little hooked, with a very broad grinding surface. Length 5 inches. "Texas;" here described from the original type, its exact origin unknown, very likely not from Texas. It is probably identical with *R. bicolor* or *R. symmetricus*.

‡*Rutilus thalassinus* possesses the following characters: Slenderer than *R. parovanus*, the color a light translucent green, quite unlike the heavy olivaceous of the latter. Head 3¾; depth 4½; A. 9; scales 9–46–4; teeth 4–5. Length 6 inches. One specimen known, from Goose Lake, Oregon. probably identical with *R. bicolor*.

of Nevada (Lake Lahontan,) and *pulverulentus* (=*parovanus*), from the basin of Utah (Lake Bonneville). In general the fish faunæ of the basins of Nevada and Utah are entirely distinct. But we know of no constant characters on which a division of this species can be maintained. (*symmetricus*, symmetrical; it being supposed to differ from *Pogonichthys macrolepidotus* in the symmetrical tail.)

*Pogonichthys symmetricus*,* Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1854, 136, Fort Miller, San Joaquin Valley. (4½ inches long).

*Algansea formosa*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 183, Merced and Mohave rivers. (5½ inches). (Type, Nos. 2754 and 2755. Coll. A. L. Heermann.)

*Algansea obesa*,† Girard, Proc. Ac. Nat. Sci. Phila., 1856, 183, Humboldt River; Girard, Pac. R. R. Surv., x, 239, 1858. (Type, No. 2752. Coll. Lieut. Beckwith.)

*Myloleucus pulverulentus*,‡ Cope, Hayden's Geol. Surv. Montana for 1871, 475, 1872, Warm Springs, Utah. (Scales 13–58–9.)

*Myloleucus parovanus*, Cope, Proc. Amer. Philos. Soc. Phila., 1874, 136, Beaver River, Utah; Cope, Zoöl. Wheeler Surv., v, 669, 1875, (1876); Cope, Proc. Ac. Nat. Sci. Phila., 1883, 143.

*Leucosomus symmetricus*, Günther, Cat., vii, 267, 1868.

*Ceratichthys symmetricus*, Jordan & Gilbert, Synopsis, 213, 1883.

*Leuciscus formosus*, Günther, Cat., vii, 245, 1868.

*Leucos formosa*, Jordan & Henshaw, Report Chief Engineers, App. NN, 193, 1878.

*Leucus formosus*, Jordan & Gilbert, Synopsis, 244, 1883.

*Leuciscus obesus*, Günther, Cat., vii, 244, 1868.

*Leucos obesus*, Jordan & Henshaw, Report Chief Engineers, App. NN, 192, 1878.

*Leucus obesus*, Jordan & Gilbert, Synopsis, 245, 1883.

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* The type of *Pogonichthys symmetricus* has no barbel; the teeth 4–5; the head 4 in length; the depth 4⅓; scales 9–53–6. It seems to be the same species as *Algansea formosa*, which has scales 10–57–7. The type specimen of *Algansea formosa* (No. 196), from Merced River, is 5½ inches long. Head 3⅚; depth (eviscerated) 4¼. Eye 5, 1⅓ in snout. Snout 4 in head. Mouth terminal, oblique, about as in No. 193, but the lower jaw slightly included. Maxillary not reaching eye. D. 8; A. 8. Scales 10–57–7. Another of these specimens has the snout shorter and a little more pointed. Scales 11–57–7. The type from Mojave River (No. 197), 4½ inches long, has head 3½; depth 4. Eye 4¾, shorter than snout, which is pointed, 4 in head. Mouth oblique; lower jaw slightly projecting. D. 8; A. 8. Scales 11–51–7. This form from Mojave River seems to correspond with specimens from tributaries of Owen Lake, Inyo County, California. These differ from typical *symmetricus* in the form of the head, agreeing in this respect with the types of *obesus* and *parovanus*. The snout in the Inyo County specimens is shorter, barely equal to the eye and not convex as in *symmetricus*; mouth very oblique; dorsal over ventrals. Scales 10–55–6. These may be the same as *R. parovanus*, the figure of which shows this form of mouth. *Rutilus parovanus* is thus described: Body rather stout; muzzle short, conical; mouth very broad, the maxillary reaching front of orbit; profile gently arched; eye large, 3 in head, equal to interorbital width; pectorals reaching little more than half way to ventrals; the latter just to vent. Translucent, with a plumbeous lateral band. Ventrals and pectorals dusky; dorsal and caudal shaded with dark. Head 3½; depth 4¼. D. 9; A. 8. Scales 10–48–5; teeth 4–5. Length 12 inches. (Cope.) Beaver River, Utah, a tributary of Sevier River.

† *R. obesus* is apparently identical with *Rutilus symmetricus*. Body stout; head short; snout 4 in head, moderately pointed, not much convex. Mouth oblique, lower jaw not projecting; maxillary not reaching eye. Head 3½; depth 3½; eye 5, 1⅓ in snout. Scales 12–57–8. Length 6¼ inches. Here described from notes on Girard's type (No. 194, U. S. Nat. Mus.) from Humboldt River.

Another of Girard's specimens (No. 193, U. S. Nat. Mus.) from Humboldt River is 6¾ inches long. Head 3¾; depth 3⅛. Eye 5 in head, 1½ in snout, which is 3⅝ in head. Mouth terminal, oblique, the lower jaw scarcely projecting; maxillary not reaching eye; snout pointed. Scales 14–58–8. D. 9; A. 8.

Another specimen from Nevada, 5 inches long, has snout a little longer than eye; scales 11–56–6; depth 4. Still another, 8½ inches long, from "Camp 21, Nevada," has scales 12–54–6; snout not decurved; eye 1⅓ in snout. Of specimens from Truckee River, one has a convex snout very pronounced; another the snout slightly convex, the two others not convex at all.

‡ *Myloleucus pulverulentus* is thus described: Form stout; head short, muzzle not decurved; mouth terminal, slightly descending, the maxillary bone nearly attaining the anterior line of the orbit. Head 3.75 times in length, exclusive of caudal; depth 3½ times. Eye 4.2 in head, 1 in muzzle. Preorbital bone deeper than long. Scales 13–58–9. Radii: D. I, 9; A. II, 7. Caudal well forked. Length 3½ inches. A dark plumbeous band extends from the origin of the lateral line above to the caudal peduncle and on it to the caudal fin; below this the color is silvery, thickly dusted with black dots; above it is an olive-yellow band, then a dark dorsal region, all dusted; sides of head silvery, dusted; fins unspotted. Numerous specimens from the Warm Springs, Utah.

### 388. RUTILUS BOUCARDI (Günther).

Head 4; depth 4; eye moderate, 4½. D. 8; A. 9 or 10; scales 7–39–5; teeth 5–4, hooked. Body moderately elongate. Head thick, obtuse; mouth broad, its cleft not extending to the eye; snout convex, the lower jaw included. Caudal fin moderately forked. Origin of dorsal fin close behind that of the ventrals. Pectorals not reaching nearly to ventrals. Brownish; a bluish lateral band, forming a faint caudal spot. Length 3½ inches. Cuernavaca, Mexico. (Günther.) (Named for Alphonse Boucard, an ornithologist who collected largely in Mexico.)

*Leuciscus boucardi*, GÜNTHER, Cat., VII, 485, 1868, Cuernavaca, Mexico. (Coll. Boucard.)
*Leucus boucardi*, JORDAN & GILBERT, Synopsis, 246, 1883.

## 118. LUXILINUS, Jordan.

*Luxilinus*, JORDAN, Catalogue Fishes N. A., 1885, 33, (*occidentalis*).

Body oblong, strongly compressed. Ventral edge of moderate width; scaled over and not at all carinated; otherwise much as in *Abramis*. No barbels. Gill rakers slender, of moderate length. Teeth 5–5, with entire edges and well-developed grinding surface, their tips little hooked. Intestines of the short type, but longer than in most related genera; anal basis elongate. This genus seems nearest related to *Abramis* or to its section *Notemigonus*, but in its technical characters it stands near *Rutilus*. One species known. (Name, a diminutive of *Luxilus*; from *lux*, light.)

### 389. LUXILINUS OCCIDENTALIS (Baird & Girard).

Dorsal 10; A. 11; eye large, 4. Body moderately elongate; snout subconical, rather tapering. Mouth oblique, the maxillary not reaching orbit. Brownish above; sides silvery; more or less speckled with gray. San Joaquin Valley, California; not rare about Fresno. (*occidentalis*, western.)

*Leucosomus occidentalis*, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 137, Poso Creek; Four Creeks, tributaries of Tulare Lake, California. (Type, No. 57. Coll. Heermann.)
*Luxilus occidentalis*, GIRARD, Pac. R. R. Surv., x, 280, 1858.
*Abramis occidentalis*, GÜNTHER, Cat., VII, 305, 1868.
*Notemigonus occidentalis*, JORDAN & GILBERT, Synopsis, 250, 1883.

## 119. OPSOPŒODUS, Hay.

*Opsopœodus*, HAY, Proc. U. S. Nat. Mus., 1880, 507, (*emiliæ*).
*Trycherodon*, FORBES, in JORDAN & GILBERT, Synopsis, 247, 1883, (*megalops*).
*Opsopœa*, JORDAN & EVERMANN, new subgenus (*bollmani*).

Mouth very small, terminal. Body fusiform. Upper jaw protractile; no barbels. Teeth 5–5 or 4–5, with little or no grinding surface and with serrated edges, the tip strongly hooked. Abdomen not compressed. Dorsal nearly over ventrals. Anal basis short. Lateral line complete, or more or less imperfect. Intestinal canal short. Peritoneum white. Singular fishes, of small size, confined to Eastern America. (*ὀχοποιέω*, to feed daintily; *δούς*, tooth.)

OPSOPŒODUS:
- *a.* Mouth very oblique, terminal, its cleft almost vertical; no distinct caudal spot.
  - *b.* Lateral line complete, or very nearly so.
    - *c.* Dorsal fin plain, without distinct dark markings; head very slender. OSCULUS, 390.

*cc.* Dorsal with black blotch on its anterior rays, usually none posteriorly; head deeper. EMILIÆ, 391.

*bb.* Lateral line always incomplete; dorsal usually with a conspicuous black blotch on its posterior portion. MEGALOPS, 392.

OPSOPŒA, (ὀΨοποιέω, to feed daintily):

*aa.* Mouth scarcely oblique, its cleft almost horizontal; a black caudal spot nearly as large as eye; lateral line imperfect. BOLLMANI, 393.

### Subgenus OPSOPŒODUS.

#### 390. OPSOPŒODUS OSCULUS, Evermann.

Head 4½; depth 4⅓ to 5; eye 3. D. 10; A. 8; scales 7–38 to 41–3; teeth 4–5 or 4–4, serrate and hooked. Body slender; head subconic, its depth at eye but half its length; snout blunt, shorter than eye. Mouth very small, almost vertical. Breast naked; scales before dorsal small. Lateral line complete. Pale, with brown specks along edges of scales above; a narrow plumbeous lateral band; sometimes two rows of specks above and one below it; no black caudal spot and no black blotch on dorsal. Peritoneum silvery. Rio Neches, and other streams about Palestine and Houston, Texas. Very close to *O. emiliæ,* but quite different in color markings, possibly a subspecies of *O. emiliæ.* (*osculus*, a small mouth.)

*Opsopœodus osculus*, EVERMANN, U. S. Fish Comm. Expl. in Texas, 82, 1892, Neches River, near Palestine, Texas. (Type, No. 45560. Coll. Evermann, Scovell & Gurley.)

#### 391. OPSOPŒODUS EMILIÆ, Hay.

Head about 4½; depth 4⅖; eye 3. D. 9; A. 8; scales 5–40–3; teeth 5–5, very slender, strongly hooked, and deeply serrate. Body rather elongate, moderately compressed, not elevated. Head short, slender. Muzzle blunt and rounded. Mouth very small and very oblique, smaller than in any other of our *Cyprinidæ,* with scarcely any lateral cleft; its size, when opened wide, less than that of the eye. Mandible short and deep, strongly curved; jaws equal. Eye longer than snout. Dorsal beginning over posterior rays of ventrals, nearer snout than base of caudal. Pectoral small, not reaching ventrals, the latter to anal. Caudal peduncle long and slender, the caudal long and deeply forked. Anal short and deep. Breast naked; 16 large scales before dorsal. Lateral line complete or very nearly so. Yellowish; sides silvery; scales above dark-edged; usually a dark lateral band from snout to caudal, above and below which are series of black dots; no distinct caudal spot; anterior rays of dorsal dark; no black spot on the posterior rays. Sandy lowland streams, Lake Erie and southern Indiana (New Harmony) to Georgia and Mississippi. Rather scarce, but widely distributed. (Named for Mrs. Emily Hay.)

*Opsopœodus emiliæ*, HAY, Proc. U. S. Nat. Mus., 1880, 507, Artesia, Macon, and Enterprise, Mississippi. (Type, No. 32222. Coll. Hay.) JORDAN & GILBERT, Synopsis, 247, 1883.

#### 392. OPSOPŒODUS MEGALOPS (Forbes).

Head 4¾; depth 4 to 5; eye 2¾. D. 7 or 8; A. 7 or 8; scales 5–39–4, 15 before dorsal. Teeth 5–5, hooked and crenate. Lateral line always incomplete, sometimes on 4 or 5 scales only, sometimes extending with interruptions to middle of caudal peduncle. Body slender, fusiform;

mouth small, terminal oblique. Eye very large, longer than snout; fins large, the caudal long, deeply forked; pectorals extending ¾ distance to ventrals. Breast partly naked. Yellowish brown, sides faintly silvery; scales above dark-edged. Dorsal with a submedian black blotch in front on 4 rays; a second blotch usually present on 3 posterior rays. Length 2⅓ inches. Western Ohio to Illinois, replacing *O. emiliæ* northward; perhaps not a distinct species. (*μεγαλόψ*, large-eyed.)

*Trycherodon megalops*, Forbes, in Jordan & Gilbert, Synopsis, 248, 1883, Illinois River at Pekin and Peoria; Mackinaw Creek, Illinois. (Type, No. 28406. Coll. Forbes.)

### Subgenus OPSOPŒA, Jordan & Evermann.

### 393. OPSOPŒODUS BOLLMANI, Gilbert.

Head 4⅖; depth 4⅔ to 5; eye 3⅔. D. 8; A. 8; scales 5-37-4. Head small, snout compressed, slender, somewhat rounded at tip, resembling *Hybopsis labrosus.* Mouth small, subterminal, slightly overhung by the snout, its cleft slightly oblique; maxillary reaching vertical from posterior nostril, shorter than snout, 4½ in head. Eye equal to snout. Teeth 4-5 or 5-5, with well-developed grinding surface, one edge of which is conspicuously serrated, but less so than in *O. emiliæ.* Insertion of dorsal behind ventrals, slightly nearer caudal than snout; caudal deeply forked; lower fins moderate. Lateral line present on 7 or 8 scales only; breast scaled. Dark olive, the scales edged with dusky; a black lateral band through eye to caudal; chin black; a **V**-shaped pale area on snout; a black spot nearly as large as eye at base of caudal; a dark dorsal streak and one backward from anal; fins dusky; males with a black blotch on first two dorsal rays; marginal third of fin dusky; anal and ventrals bordered with black. Length 2 inches. Lowland swamps, known from Satilla River, Waycross, Georgia, and Obion River, Cypress, Tennessee. (Named for Charles Harvey Bollman, who first obtained the species and who died untimely of fever, taken in the Georgia swamps.)

*Opsopœodus bollmani*, Gilbert, Bull. U. S. Fish Comm., viii, 1888, 226, 1890, Buckland Creek, Millen, Georgia. (Coll. Bollman & Fesler.) Woolman, Bull. U. S. Fish Comm., x, 1890, 272, 1892.

## 120. ABRAMIS, Cuvier.

### (Breams.)

*Abramis*, Cuvier, Règne Animal, Ed. i., 111, 1817, (*brama*).
*Notemigonus*, Rafinesque, Journ. de Physique, de Chymie, et d'Hist. Nat., Paris, 1819, 421, (*auratus*).
*Hemiplus*, Rafinesque, Annals Nature, i, 6, 1820, (*lacustris*).
*Stilbe*, De Kay, New York Fauna: Fishes, 204, 1842, (*chrysoleuca*).
*Ballerus*, Heckel, Russegger's Reisen, i, 1032, 1843, (*ballerus*).
*Stilbius*, Gill, Canadian Naturalist, 1865, 18, (*americanus*).
*Abramidopsis*, Siebold, Süsswasserfische Oesterreichs, 117, 1863, (*leuckarti*; hybrid with *Rutilus*).

Body subelliptical, strongly compressed, both back and belly curved; back narrowly compressed; belly behind ventral fins forming a keel over which the scales do not pass. Head small, conic. Mouth small, oblique or horizontal, without barbels. Scales rather large. Lateral line continuous, strongly decurved. Dorsal fin inserted behind the ventrals.

Anal fin with its base more or less elongate, of from 13 to 40 rays; (9 rays in one species). Teeth 5–5, hooked, with grinding surface, the edges of which, in American species, are more or less crenate. Alimentary canal short, though rather longer than the body. Size rather large. As here understood, the American genus *Notemigonus* is included in *Abramis*, from which it differs in the much shorter anal fin, from 9 to 18 rays instead of 20 to 40. There is much variation in the length of the anal and in the form of the mouth among the species left in *Abramis*, and a reunion or a different division of the group may be necessary. In the American species, *Notemigonus*, the teeth are more or less crenate, in form approaching the serrated teeth of the European genus *Scardinius*. In the European subgenera, *Abramis* and *Ballerus*, the teeth are entire. In *Ballerus* there are 30 to 40 anal rays; in *Abramis* proper 20 to 28. (*Abramis*, an old name of the Bream, *Abramis brama.*)

NOTEMIGONUS (νῶτος, back; ἡμι-, half; γωνία, angle; the back being almost carinated.)
 *a.* Teeth crenate or serrate; mouth terminal; anal shortish, its rays less than 20.
  *b.* Anal fin with 12 to 18 rays; scales in the lateral line 43 to 55. CRYSOLEUCAS, 394.
  *bb.* Anal fin with 9 or 10 rays; scales in lateral line about 40. GARDONEUS, 395.

### Subgenus NOTEMIGONUS, Rafinesque.

### 394. ABRAMIS CRYSOLEUCAS (Mitchill).

(GOLDEN SHINER; ROACH; BREAM.)

Head 4½; depth 3; eye moderate, about 4 in head. D. 8; A. 13, (12 to 14); scales 10–46 to 55–3; teeth 5–5. Body moderately elongate, strongly compressed. Head short, subconic, compressed, the profile somewhat concave. Mouth small, oblique, the upper lip on level of upper part of pupil, the maxillary not reaching front of eye. Fins medium. Color clear greenish above; sides silvery, with bright golden reflections; fins yellowish, the tips of the lower fins sometimes slightly orange in spring males. Length 12 inches. Nova Scotia and Maryland to Dakota and Texas; everywhere abundant in bayous and weedy ponds. One of the most familiar and characteristic of our *Cyprinidæ*. (χρυσός, gold · λευκός, white.

*Cyprinus crysoleucas*, MITCHILL, Rept. Fish. N. Y., 23, 1814, New York

*Cyprinus hemiplus*, RAFINESQUE, Amer. Monthly Mag., 1817, 121 Lake George; Saratoga Lake.

*Notemigonus auratus*, RAFINESQUE, Journ. Phys., 1819, 421, Falls of Ohio River.

*Hemiplus lacustris*, RAFINESQUE, "Annals of Nature, I, 6," 1820, Lake George.

*Abramis versicolor*, DE KAY, N. Y. Fauna: Fishes, 191, 1842, Connecticut and Hudson rivers; Peekskill.

*Luxilus seco*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 203, Rio Seco, tributary of Rio Nueces, Texas. (Coll. Kennerly.)

*Luxilus leptosomus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 203, and U. S. Mex. Bound. Surv., Ichth., 60, 1859, Dry Creek, Victoria, Texas. (Coll. Kennerly.)

*Leuciscus*, *Leucosomus*, *Luxilus*, *Plargyrus*, *Stilbe*, *Stilbius*, or *Abramis americanus* of various authors, (not *Cyprinus americanus*, L., 1758.)

*Stilbe americana*, COPE, Cypr. Penn., 389, 1866.

*Leucosomus americanus*, STORER, Fishes Mass., 283, 1867.

*Abramis americanus*, GÜNTHER, Cat., VII, 305, 1868.

*Abramis ? leptosomus*, GÜNTHER, Cat., VII, 306, 1868.

*Notemigonus chrysoleucus*, JORDAN, Bull. U. S. Nat. Mus., X, 65, 1877; JORDAN & GILBERT, Synopsis, 250, 1883.

*Notemigonus leptosomus*, JORDAN & GILBERT, Synopsis, 250, 1883.

Represented southward by

### 394a. ABRAMIS CRYSOLEUCAS BOSCI (Cuvier & Valenciennes).

Head 4½; depth 3½; eye 3. D. 8; A. 15 to 17; scales 8–43 to 50–2; teeth 5–5. Scales larger, the anal fin more elongate, and the male with brighter colors. Body moderately elevated, very strongly compressed; head rather broad and flat between the eyes; mouth small, quite oblique, the maxillary barely reaching the eye; eye very large and prominent, anterior. Dorsal fin short and very high, almost falcate, well back; anal fin high and long. Scales rather large, the lateral line running very low. Color pale olive, with silvery luster; lower fins red in the males in spring. Length 12 inches. Rivers of the South Atlantic States; abundant from the James to the Altamaha and St. Johns; intergrading with the typical form. (Named for M. Bosc, a French naturalist and collector, consul at Charleston toward the end of the eighteenth century.)

*Leuciscus bosci*, CUVIER & VALENCIENNES, XVII, 313, 1844, Carolina; Pennsylvania; New York.

*Cyprinus americanus*, LINNÆUS, Syst. Nat., Ed. XII, 530, 1766, Charleston; not of Ed. X, 1758, which is *Menticirrhus*.

*Notemigonus ischanus*, JORDAN, Ann. Lyc. Nat. Hist. N. Y., 1876, 364, South Fork Ocmulgee River, Flat Shoals, Georgia. (Type, Nos. 17865 and 20112. Coll. Jordan.)

*Notemigonus americanus*, JORDAN & GILBERT, Synopsis, 250, 1883.

### 395. ABRAMIS GARDONEUS (Cuvier & Valenciennes).

Head 5½; depth 3⅗; eye 4 in head. D. 10; A. 9; teeth 5–5, with grinding surface and serrated edge; scales 7–39–3. Body moderately elongate, compressed. Head obtuse. Isthmus narrow. Mouth small, oblique, the lower jaw included. Dorsal nearly midway of body, little behind ventrals. Olivaceous. South Carolina; one specimen known, perhaps a hybrid between *A. crysoleucas* and some other fish. (*Gardon*, a French name of the Roach, *Rutilus rutilus.*)

*Leuciscus gardoneus*, CUVIER & VALENCIENNES, XVII, 316, 1844, Charleston; GÜNTHER, Cat., VII, 258, 1868.

*Chondrostoma gardoneum*, COPE, Trans. Amer. Phil. Soc. Phila., 1866, 395.

*Notemigonus gardoneus*, JORDAN & GILBERT, Synopsis, 250, 1883.

## 121. COCHLOGNATHUS, Baird & Girard.

*Cochlognathus*, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 158, (*ornatus*).

This genus has the general character and appearance of *Cliola* and *Pimephales*, the dentition and the structure of the fins being the same; the teeth, however, are rather more strongly hooked and with deeper grinding surface. It differs in the structure of the jaws, which are provided each with a hard cutting plate, in appearance similar to that of *Diodon*, the sharp, bony edge being surrounded by the usual lip. First ray of dorsal separated by membrane, and spine-like, as in *Cliola* and *Pimephales*. Alimentary canal short. Peritoneum white. Pseudo branchiæ present. Lateral line complete. Anal fin small. Spring males with tubercles and dark pigment as in *Pimephales*. We place this genus and *Cliola* in the neighborhood of *Notropis*, on account of the shortness of the intestines, but it is likely that their real relations are with *Pimephales*, and that the reduction in the length of the alimentary canal is a character independently developed. (*κόχλος*, shell; *γνάθος*, jaws; the covering of the jaw being hard, like shell.)

*a.* Scales moderate, about 40 in the lateral line. ORNATA, 396.
*aa.* Scales large, about 34 in lateral line. BIGUTTATA, 397.

### 396. COCHLOGNATHUS ORNATA, Baird & Girard.

Head 4; depth 4¼. D. 8; A. 6; lateral line 40; teeth 4–4. Appearance, dorsal fin, and coloration much as in *Pimephales notatus* or *Cliola vigilax*. Body moderately elongate. Head rather long. Dorsal fin over the ventrals, rather high; anal fin quite small; caudal fin short. Dorsal fin with a black spot near the base in front and a dusky blotch behind; caudal fin with a dusky median band, in front and behind which is a pale area; a dusky lateral band. Snout tuberculate in spring males, as in *Pimephales*. Length 3 inches. Rio Grande. A singular little fish, with the mouth resembling that of *Chondrostoma* or *Acrocheilus*, but the structure otherwise different from either. (*ornatus*, adorned.)

*Cochlognathus ornatus*, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 158, Brownsville, Texas; GÜNTHER, Cat., VII, 187, 1868; JORDAN & GILBERT, Synopsis, 161, 1883.

### 397. COCHLOGNATHUS BIGUTTATA, Cope.

Head 5 in length, with the caudal fin; depth a little less. Eye large, 3⅖ in head, a little less than muzzle and than interorbital space. D. 8; A. 7; scales 7–34–? Form of *Pimephales notatus*. Head oblong and rather wide above. Muzzle decurved in profile; mouth terminal. Head wide behind and flat above. Maxillary not quite reaching line of orbit. Ventral fins inserted opposite second or third dorsal ray, reaching to vent; anal fin small. Pectorals reaching three-fifths to ventrals. Color silvery, without dark markings, except a black spot at the base of the caudal and on the anterior rays of the dorsal. Length 2½ inches. Trinity River, Texas. Very close to the preceding, from which it may perhaps differ in the larger scales. (Cope.) (*biguttatus*, two-spotted.)

*Cochlognathus biguttata*, COPE, Bull. U. S. Nat. Mus., XVII, 1880, 37, Trinity River, Fort Worth, Texas. (Coll. Cope.) JORDAN & GILBERT, Synopsis, 161, 1883.

## 122. CLIOLA, Girard.

*Ceratichthys*,* BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1853, 390; (name only; no definition; applied to *vigilax*, which was not intended as type).
*Cliola*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 192, (*vigilax*).
*Hypargyrus*, FORBES, Proc. U. S. Nat. Mus., 1884, 200, (*tuditanus*).

Form and appearance of *Pimephales*, the same squamation, fin rays and plan of coloration, and the first ray of the dorsal similarly separated by membrane, the structure of the mouth similar, but with the intestinal canal short, shorter than body, the peritoneum pale and the teeth more hooked, as in *Notropis*. The single species bears a striking resemblance to *Pimephales notatus*, but is distinguishable by the more contrasted coloration and by the generic characters which ally it, with *Cochlognathus*, to the carnivorous species called *Notropis*. The genus is certainly very near *Pimephales* although in its technical characters it approaches nearer to *Notropis*. (A coined name, without meaning, first applied to a railway station in Illinois.)

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*We do not use the name *Ceratichthys* for this genus, because no explanation of its use was given in the paper when it first appeared. It was at that time a MS. name of Professor Baird for the group typified by *Hybopsis kentuckiensis*, and to this group *C. vigilax* was wrongly referred.

*a.* Anterior dorsal rays with a black spot. VIGILAX, 398.
*aa.* No black spot on dorsal fin. SMITHII, 399.

### 398. CLIOLA VIGILAX (Baird & Girard).

Head 4¼; depth 4½; eye large, 3½ in head. D. 8; A. 7; scales 8–42–6; teeth 4–4, with grinding surface, and slight hook. Body stout, somewhat compressed, broad and flat above, with deep caudal peduncle. Head broad and flat above, with an angle at the temporal region. Muzzle broad and obtuse, less truncate than in *Pimephales notatus.* Mouth rather small, but larger than in *Pimephales,* horizontal, terminal, the jaws about equal, maxillary not reaching to opposite anterior margin of eye. Dorsal inserted above ventrals, nearer snout than caudal. Scales before dorsal small and crowded, as in *Pimephales,* in about 28 series. Dusky yellowish; sides silvery, with an obsolete dark lateral band, which terminates in a jet-black spot; a very distinct black spot on anterior rays of dorsal about half way up. Length 3 inches. Strongly resembles *Pimephales notatus,* but more silvery, less plumbeous, and the black spots more sharply defined. The spring males have little if any black pigment. Ohio to Georgia, Iowa and Texas, very abundant; southwest as far as the Rio Grande. (*vigilax,* watchful.)

*Ceratichthys vigilax,* BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1853, 390, Otter Creek, North Fork of Red River, Arkansas. (Coll. Capt. Geo. B. McClellan.)

*Cliola vigilax, Cliola velox,* San Pedro Creek, tributary of Rio San Antonio (Type, No. 30. Coll. Lieut. A. W. Whipple), and *Cliola vivax,* Rio Leon, tributary of Rio San Antonio, Texas, GIRARD, Proc. Ac. Nat. Sci. Phila. 1856, 192; and in Pac. R. R. Surv., x, 257, 258, 1858. *C. vivax* is said to have scales "a good deal smaller," but no data are given; the types of all three are now lost.

*Hybopsis tuditanus,* COPE, Cypr. Penn., 381, 1866, Detroit, Michigan.

*Alburnops taurocephalus,* HAY, Proc. U. S. Nat. Mus., 1880, 503, Chickasawha River, Enterprise, Mississippi. (Type, No. 27439. Coll. Hay.)

*Leuciscus tuditanus,* GÜNTHER, Cat., VII, 259, 1868.

*Hypargyrus tuditanus,* GILBERT, Proc. U. S. Nat. Mus., 1884, 200.

*Cliola tuditana, taurocephala,* and *vigilax,* JORDAN & GILBERT, Synopsis, 165, 166, and 169, 1883.

### 399. CLIOLA SMITHII, Evermann & Cox.

Head 4; depth 3⅔; eye 4; snout 4; interorbital width 3. D. I, 8; A. 7; scales 9–47–6, 27 before the dorsal. Teeth 4–4, not hooked, grinding surface slightly developed. Intestine not long. Body short and stout, compressed; head moderate; mouth small, terminal, slightly oblique; maxillary not reaching eye; preorbital broad. Back considerably arched; caudal peduncle deep, its least depth 2 in head. Origin of dorsal fin over ventrals, nearer snout than base of caudal. Color, above densely covered with fine black specks, giving a general blue-black appearance; sides with a broad plumbeous band ⅔ as broad as eye, darkest and best defined on caudal peduncle; sides below this band with a few scattered specks anteriorly; lower part of caudal peduncle pale; top and upper parts of sides of head bluish-black; dorsal, anal, and pectorals with a few dark specks; other fins plain. Length 2½ inches. Southern South Dakota, known only from Prairie Creek near Scotland. (Named for Dr. Hugh M. Smith, Chief of the Statistical Division of the U. S. Fish Commission.)

*Cliola smithii,* EVERMANN & COX, Rept. U. S. Fish Comm., XIX, 1895, Prairie Creek, Scotland, South Dakota. (Type, No. 45681. Coll. Evermann, Rutter, & Cox.)

## 123. NOTROPIS,* Rafinesque.

(SHINERS.)

*Notropis*, RAFINESQUE, Amer. Monthly Mag., II, 1818, 204, (*atherinoides*).
*Minnilus*, RAFINESQUE, Ich. Oh., 45, 1820, (*dinemus*).
*Luxilus*, RAFINESQUE, *l. c.*, 47, (*chrysocephalus*).
*Plargyrus*, RAFINESQUE, *l. c.*, 47, (*plargyrus*).
*Hypsolepis*, (BAIRD), AGASSIZ, Amer. Journ. Sci. Arts, 1854, 359, (*cornutus*).
*Alburnellus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 193, (*dilectus*).
*Alburnops*, GIRARD, *l. c.*, 194, (*blennius*).
*Codoma*, GIRARD, *l. c.*, 194, (*ornata*).
*Cyprinella*, GIRARD, *l. c.*, 196, (*bubalinus*).
*Moniana*, GIRARD, *l. c.*, 199, (*lutrensis*).
*Hudsonius*, GIRARD, *l. c.*, 210, (*hudsonius*).
*Photogenis*, COPE, Trans. Amer. Phil. Soc., 1866, 378, (*spilopterus*).
*Graodus*, GÜNTHER, Cat. Fishes, VII, 485, 1868, (*nigrotæniatus*).
*Lythrurus*, JORDAN, Man. Vert. E. U. S., Ed. 1, 272, 1876, (*diplemius*).
*Episema*, COPE & JORDAN, Proc. Ac. Nat. Sci. Phila., 1877, 77, (*scabriceps*; name preoccupied).
*Hydrophlox*, JORDAN, Bull. U. S. Nat. Mus., XII, 18, 1878, (*rubricroceus*).
*Erogala*, JORDAN, *l. c.*, 20, (*stigmaturus*).
*Chriope*, JORDAN, Bull. Hayden's Surv. Terr., IV, 787, 1878, (*bifrenatus*).
*Miniellus*, JORDAN, Man. Vert., Ed. V, 56, 1890, (*procne*).
*Azteca*, JORDAN & EVERMANN, new subgenus, (*vittata* = *aztecus*).
*Orcella*, JORDAN & EVERMANN, new subgenus, (*orca*).

Body oblong or elongate, more or less compressed. Mouth normal, mostly terminal and oblique, sometimes subinferior. No barbels. Teeth in one or two rows, those of the larger row always 4–4, hooked, sharp-edged or with a narrow grinding surface. Scales large, often closely imbricated, those before the dorsal rarely very small. Lateral line complete or nearly so, usually decurved. Dorsal fin inserted above, or more usually behind, the ventrals; anal fin short or somewhat elongate. Abdomen rounded, never sharp-edged. Coloration more or less silvery, often brilliant, the males in spring usually with red or white pigment and the head with small tubercles. A very large group of small fishes, especially characteristic of the fresh waters of the Eastern United States.

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* The following is Rafinesque's original account of *Notropis* and its typical species:

*N. G. Notropis:* Holobranchial abdominal. Body elongated compressed, back carinated, nearly straight, belly not carinated, scarcely bowed, a lateral line and a longitudinal silver band; vent nearer the tail than the head. Head oval compressed, convex above, mouth diagonal large, jaws without teeth, the lower longer and mobile, the upper extensible; eyes very large; gill cover large, smooth valviform, three branchial rays. One dorsal fin opposed to the interval between the anal and abdominal fins, which have nine rays.

*Observations.*—The generic name means carinated or keeled back. It forms a remarkable new genus, belonging to the third natural order *Gastripia* or the abdominals, the sixteenth natural family *Cyprinia*, and the second subfamily *Gymnopomia*, (see Analysis of Nature) together with the genera *Cyprinus*, *Atherina*, *Hydrargyra*, *etc.* It differs from the first by the compressed body, carinated back, lateral band, large mouth. deep-cleft gill cover, etc., and from the two last genera by the three branchial rays, nine rays to the abdominal fins, want of teeth, etc.

*Notropis atherinoides:* Head silvery, brown above; body pale fulvous, transparent, with a broad silver band; lateral line in the band; fins whitish, dorsal, and anal with eleven rays, the first very short, tail slightly forked.

*History.*—This new fish was discovered in Lake Erie by Gov. De Witt Clinton, who had the kindness to present me with many specimens; they are now deposited in the Lyceum of Natural History. I have ascertained that they belonged to a new genus, next to *Atherina*, and the specific name which I have adopted implies such an affinity. These fishes come on the shores of Lake Erie, and even in the river of Niagara, in the spring, in great shoals; but they are so small that they are scarcely noticed, and escape through the common nets; their usual size being from one to two inches, and very thin and slender; they are called *Minny* or *Minnow*, together with twenty different other species of fish, and often considered as the young of other fishes. They live in the depth of the lake at other seasons, and are probably common all over the great lakes. Their eyes are exceedingly large, occupying nearly the whole foreside of the head, the lips are very thin and membranaceous, the nostrils large, the gill cover is nearly round, and split above to the eyes; they have small, thin, broad scales, the rays of the fins are scarcely articulated, simple and brittle; the pectoral fins have about fifteen rays, and the caudal fin about twenty-four.—*Rafinesque.*

As here understood, *Notropis* contains about 100 species of small Cyprinoids, all of them confined to the streams of North America east of the Rocky Mountains. They are in some respects a degenerate type—probably of comparatively recent origin and perhaps descended from such forms as the European *Alburnus* and *Leuciscus.* They are feeble fishes of small size, none of them of value as food for man, but of great importance as food for the larger predatory fishes, particularly the *Centrarchidæ.* The species are highly variable, readily affected by surrounding conditions while the really distinctive characters are very few. The identification of species is very difficult and in the case of young specimens often impossible. The following analytical key must be used with great caution as all characters are subject to individual variations. Even the dentition is subject to variations, the ancestors of the group having probably originally had grinding surfaces to the teeth, this becoming rudimentary in some forms and disappearing altogether in others closely related. Various attempts have been made to break up this group into smaller genera, by subdivision according to the dentition. The various groups heretofore proposed by Girard, Cope, and Jordan seem at the most to indicate sections of slight systematic value. The most practicable division is that made in the Synopsis of Fishes of North America, by which the name *Notropis (Minnilus)* is retained for the species having the teeth 2, 4–4, 2, while those with but one tooth in the inner row, or with the inner row wanting, would stand as *Alburnops.* The frequent presence of two teeth in one or both inner rows in two species (*heterodon, hudsonius*) belonging to *Alburnops*, renders this division of the genus unsatisfactory. (*νῶτος*, back; *τρόπις*, keel, but the supposed keel of Rafinesque's type was due to shriveling in drying.)

*a.* Teeth 4–4; 1, 4–4, 0; or 1, 4–4, 1, (sometimes two teeth in one or both inner rows in *N. hudsonius* and *N. heterodon*).

*b.* Scales not very closely imbricated, not notably deeper than long; dorsal inserted nearly over the ventrals; anal short, its rays 7 or 8; no black spot on dorsal fin.

*c.* Teeth one-rowed, 4–4, the grinding surface more or less developed at least on one or two teeth. (Teeth sometimes 2, 4–4, 2 in *N. heterodon.*)

AZTECA, (Aztec, the ancient rulers in Mexico):

*d.* Scales small, about 50 in lateral line; body compressed; scales before the dorsal small; head blunt, nearly round; coloration plain. AZTECUS, 400.

*dd.* Scales moderately large, 31 to 45 in lateral line.

CHRIOPE, (*χρεία*, want; *ὤπη*, aperture):

*e.* Lateral line usually (but not always) more or less incomplete; scales before the dorsal large. Small species, usually with a dusky lateral band.

*f.* Snout very obtuse; lower jaw not projecting.

*g.* Mouth moderate, the maxillary extending to opposite front of eye or nearly so.

*h.* Chin black. BIFRENATUS, 401.

*hh.* Chin pale. JORDANI, 402.

*gg.* Mouth very small, the maxillary not nearly reaching front of eye.

*i.* Chin pale. MACULATUS, 403.

*ii.* Chin black. ANOGENUS, 404.

*ff.* Snout rather pointed; lower jaw projecting.

*j.* Mouth very small; chin pale. CAYUGA, 405.

*jj.* Mouth moderate; chin black. HETERODON, 406.

ALBURNOPS, (*alburnus*, the bleak, from *albus*, white; ὤψ, appearance):

*ee.* Lateral line always complete; scales large, fewer than 40 in lateral line; teeth 4–4, well hooked. Small, weak species.

*k.* Body rather elongate, the depth not more than ¼ the length.

*l.* Scales before the dorsal 17 in number; aspect of *N. heterodon.*
FRETENSIS, 407.

*ll.* Scales before the dorsal 12 to 15 in number.

*m.* Body not marked with distinct round dark spots; the spots, if any, mere punctulations.

*n.* Base of caudal without distinct black spot, (except in the very young).
BLENNIUS; SABINÆ; VOLUCELLUS; SCYLLA; PROCNE; NIGROTÆNIATUS; and KANAWHA, 408–414.

*nn.* Base of caudal with a small black spot more or less distinct.
BRAYTONI; SPECTRUNCULUS; OZARCANUS, 415–417.

*mm.* Body with many irregular round black spots and dots, the largest often nearly as large as pupil; form rather stout.
CHIHUAHUA, 418.

*kk.* Body short and chubby, the depth more than ¼ the length.
TOPEKA, 419.

HUDSONIUS, (from Hudson River):

*cc.* Teeth two-rowed, 1, 4–4, 0 or 1, 4–4, 1 or 2; the grinding surface more or less developed.

*o.* Head comparatively large, 3½ to 4¼ in body; teeth, 1, 4–4, 1; small, slender species, without distinct dark spot at base of caudal.

*p.* Eye moderate, 3½ to 4 in head in adult.
GILBERTI; PIPTOLEPIS; SIMUS; LONGIROSTRIS, 420–423.

*pp.* Eye very large, 3 to 3½ in head in adult.
NUX; NOCOMIS; SHUMARDI; ILLECEBROSUS, 424–427.

*oo.* Head short, bluntish, 4 to 5 in body in adult; species of large size and silvery coloration, usually with a distinct black spot at base of caudal fin.
HUDSONIUS, 428.

*bb.* Scales deeper than long, more or less closely imbricated along sides of body; teeth with the edges often crenate, the grinding surface sometimes narrow or obsolete.

*q.* Teeth one-rowed, 4–4, the young sometimes 1, 4–4, 1.

CODOMA, (a coined name):

*r.* Head very thick, bluntly rounded on every side; mouth small, oblique, its cleft chiefly anterior; scales large, about 40 in lateral line. ORNATUS, 429.

MONIANA, (a coined name):

*rr.* Head compressed, not bluntly rounded.

*s.* Dorsal without distinct black blotch on its upper posterior portion; body more or less deep and compressed.

*t.* Scales small, 43 in lateral line; a dusky spot at base of caudal.
FORMOSUS, 430.

*tt.* Scales moderate, 33 to 38 in lateral line; adult without caudal spot.
FRIGIDUS; LUTRENSIS; PROSERPINA, 431–433.

*ss.* Dorsal with a black spot on its last rays above, the fin very high.
CALLISEMA, 434.

CYPRINELLA, (diminutive of *Cyprinus*, carp):

*qq.* Teeth two-rowed, 1, 4–4, 1.

*u.* Anal fin moderate, of 7 to 9 rays.

*v.* Dorsal fin without large black blotch on its upper posterior rays in adult.

*w.* Caudal fin without black spot at its base in adult.

*x.* Body deep, compressed, broadly elliptical in outline.
BUBALINUS, 435.

*xx.* Body subfusiform in outline.
LUDIBUNDUS; MACROSTOMUS, 436; 437.

*ww*. Caudal fin with a distinct black spot at base in all ages.
TEXANUS; NOTATUS; VENUSTUS, 438–440.

*vv*. Dorsal fin with a large black blotch on its upper posterior rays in adult (often obsolete in young), always conspicuous in old males; the fins in males with satin-white, and often with red, pigment.

*y*. Base of caudal with a conspicuous black spot.

*z*. Fins in males with white or orange pigment, but no red.
CERCOSTIGMA; STIGMATURUS, 441; 442.

*zz*. Fins in males with red pigment.
TRICHROISTIUS; CALLISTIUS; EURYSTOMUS, 443–445.

*yy*. Base of caudal without a conspicuous black spot; no red pigment.
CÆRULEUS; NIVEUS; WHIPPLII; ANALOSTANUS;
GALACTURUS; CAMURUS, 446–451.

*uu*. Anal fin long, of 10 or 11 rays; fins high; breeding colors brilliant, the males largely red.

*a'*. Dorsal fin with a conspicuous black blotch on its last rays.

*b'*. Caudal with a dark spot at base. XÆNURUS; HYPSELOPTERUS, 452; 453.

*bb'*. Caudal with a dusky cross-band, but without dark spot at base.
PYRRHOMELAS, 454.

*aa'*. Dorsal fin in males without black blotch. GARMANI, 455.

*aa*. Teeth 2, 4–4, 2.

*c'*. Anal fin short, its developed rays 7 to 9, sometimes 10 in *N. zonistius*.

*d'*. Teeth with the grinding surface developed.

LUXILUS (from *lux*, light):

*e'*. Species attaining a large size, with the scales along the sides very closely imbricated so that the exposed surfaces are very narrow; lower jaw included; dorsal over ventrals; adult with neither dorsal nor caudal spot.
CORNUTUS; CERASINUS; ALBEOLUS; LACERTOSUS, 456–459.

HYDROPHLOX, (ὕδωρ, water; φλώξ, flame):

*ee'*. Species of moderate or small size, the colors generally brilliant in spring males; dorsal inserted more or less behind ventrals; no black spot at base of dorsal.

*f'*. Lower jaw projecting. MACDONALDI; COCCOGENIS, 460; 461.

*ff'*. Lower jaw included or scarcely projecting.

*g'*. Base of caudal without dark spot.
ZONATUS; ZONISTIUS; RUBRICROCEUS; CHLOROCEPHALUS;
LUTIPINNIS, 462–466.

*gg'*. Base of caudal with a more or less evident dark spot, at least in young.
(HETERODON; HUDSONIUS.) CHILITICUS; ALTIPINNIS; ROSEUS;
CHALYBÆUS; CHROSOMUS; XÆNOCEPHALUS, 467–472.

*dd'*. Teeth without evident grinding surface; scales not closely imbricated; no black spot at base of dorsal in front; sexes usually colored alike.

OBCELLA (diminutive of Orca):

*h'*. Top of head elevated, transversely convex, so that the small eye is as near ventral as dorsal surface; body little compressed; color pale, no markings.
ORCA, 473.

NOTROPIS (part):

*hh'*. Top of head not especially elevated, the eye nearer dorsal than ventral outline of head.

*i'*. Dorsal fin inserted nearly over ventrals; no distinct black caudal spot.
ARIOMMUS; SCABRICEPS; JEJUNUS, 474–476.

*ii'*. Dorsal fin inserted more or less behind ventrals.

*j'*. Base of caudal without spot. SWAINI, 477.

*jj'*. Base of caudal with a faint spot. AMABILIS, 478.

*jjj'*. Base of caudal with a jet-black spot. LEUCIODUS; SCOPIFER, 479; 480.

*cc'*. Anal fin long, its rays 11 or 12, rarely 9; dorsal inserted behind ventrals.

Notropis, (part):

*k′*. Scales loosely imbricated, not crowded along sides; teeth mostly without grinding surface; no black spot at base of dorsal; caudal spot faint or wanting; fins mostly plain or with red; scales above lateral line usually large, in 5 to 7 series.

TELESCOPUS; SOCIUS; NOTEMIGONOIDES; STILBIUS; ATHERINOIDES;
ARGE; DILECTUS; FUMEUS; RUBRIFRONS; PHOTOGENIS;
AMŒNUS; SCEPTICUS; MICROPTERYX; METALLICUS, 481–494.

Lythrurus, (λύθον, gore; οὐρά, tail):

*kk′*. Scales more or less closely imbricated so that the exposed surfaces are deeper than long; teeth with a narrow grinding surface; scales above lateral line small, in 7 to 10 series, those before the dorsal reduced; usually a dark spot on dorsal, rarely one at base of caudal; males largely red.

- *l′*. Dorsal fin without distinct dark spot, or at the most only a few punctulations.
  - *m′*. Body short and deep. BELLUS, 495
  - *mm′*. Body slender and elongate. LIRUS, 496.
- *ll′*. Dorsal fin with a black spot on its anterior rays, more or less distinct.
  - *n′*. Black dorsal spot above the middle of the fin. ROSEIPINNIS, 497.
  - *nn′*. Black dorsal spot at the base of the fin. UMBRATILIS, 498.

### Subgenus AZTECA, Jordan & Evermann.

### 400. NOTROPIS AZTECUS, Woolman.

Head 4; depth 3½ to 4; eye 5; snout 3. D. 8; A. 8; scales 7–50–4, about 23 before dorsal, small; teeth 4–4, hooked. Body rather stout, heavy anteriorly, with long but strong caudal peduncle; back moderately arched; head blunt and heavy, but less gibbous than in *N. ornatus*; snout short, not much longer than eye; jaws subequal; mouth moderate, quite oblique, the maxillary not quite reaching eye, the cleft of the mouth chiefly anterior; eye small; scales very small for the genus, not closely imbricated. Fins all low; dorsal small, inserted behind ventrals; pectorals short, not nearly reaching ventrals. Lateral line decurved. Color, dark above, below this a silvery band, and still lower a dusky or plumbeous lateral band; young with a faint plumbeous caudal spot; fins all plain; cheeks silvery; sexes alike in color. Length 3 inches. This species has the head formed much as in *Notropis ornatus*, but in form of body, color, and in size of scales the two differ widely. Valley of Mexico. Our specimens collected by Mr. A. J. Woolman, at the City of Mexico, where it abounds in the canals. (*Aztecus*, Aztec.)

*Codoma vittata*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 195, Valley of Mexico, (Coll. Potts.); and U. S. & Mex. Bound. Surv., Ichth., 53, pl. 29, figs. 18–21, 1859.

*Notropis aztecus*, Woolman, Bull. U. S. Fish Comm., XIV, 1894, May 3, 1894, 63, plate 2, City of Mexico. (Type, No. 45569. Coll. Woolman.)

*Cliola vittata*, Jordan & Gilbert, Synopsis, 172, 1883, (not *Leuciscus vittatus*, De Kay, 1842, which is also a *Notropis*).

### Subgenus CHRIOPE, Jordan.

### 401. NOTROPIS BIFRENATUS (Cope).

Head $4\frac{1}{5}$; depth $4\frac{1}{5}$; eye 3. D. 8; A 7; scales 5–36–3; teeth 4–4. Body rather slender, the caudal peduncle somewhat contracted. Head moderate, the muzzle very obtuse. Mouth oblique, the jaws about equal; upper lip opposite lower part of pupil. Eye large, longer than snout. Lateral line developed for a very short distance. 13 scales before dorsal.

Straw-colored, the scales brown-edged above; a shining black band from snout through eye to caudal; this includes the edge of the lower jaw; an orange band above this on the snout; regions below the black band silvery. Length 1½ to 2 inches. Massachusetts to Maryland, coastwise, not common. A small but handsomely colored species. (*bis*, two; *frenatus*, bridled.)

*Hybopsis bifrenatus*, COPE, Cypr. Penn., 384, 1866, Schuylkill River, Conshohocken, Pennsylvania. (Coll. Cope.)
*Hemitremia bifrenata*, JORDAN & GILBERT, Synopsis, 162, 1883.

### 402. NOTROPIS JORDANI,* Eigenmann & Eigenmann.

Allied to *N. heterodon*. D. 9; A. 8; scales 4-35-4, 15 before dorsal. Slender; fins all small; origin of dorsal over ventral, equidistant from base of middle caudal rays and nares; scales closely imbricated, the exposed edges little higher than long. Lateral line decurved, the tubes developed on fewer than 10 scales. A plumbeous lateral band overlaid with silvery; a dark vertebral line from occiput to caudal; sides with a few dark specks, dorsal surface more densely specked, the margins of the scales darker. South Saskatchewan River, Medicine Hat, Assiniboia. (Eigenmann.) (Named for David Starr Jordan.) (Coll. Eigenmann.)

*Notropis albeolus*, EIGENMANN & EIGENMANN, Amer. Nat., February, 1893, 152, Medicine Hat.
*Notropis jordani*, EIGENMANN & EIGENMANN, *l. c.*, June, 1893, 592, substitute for *albeolus*, preoccupied in *Notropis*.

### 403. NOTROPIS MACULATUS (Hay).

Head 4½; depth 5; eye equal to snout, 3½ in head. D. 8; A. 8; scales 5-38-3; teeth 4-4, with grinding surface. Body long and slender, slightly elevated at the dorsal, somewhat compressed. Head flattened above; snout rounded. Mouth small, terminal, slightly oblique, maxillary not reaching to opposite eye. Dorsal slightly behind ventrals, nearer snout than base of caudal. Lateral line with pores on 8 to 10 scales only. Straw color; a narrow dark dorsal band, and a dark streak on each side of anal; a plumbeous lateral band, and black specks on each scale; a black spot as large as eye at base of caudal. Length 2½ inches. Chickasawha River, Mississippi. (Hay.) (*maculatus*, spotted.)

*Hemitremia maculata*, HAY, Proc. U. S. Nat. Mus., 1880, 505, Chickasawha River, Enterprise, Mississippi, (Type, Nos. 32245 and 27438. Coll. Hay.) JORDAN & GILBERT, Synopsis, 162, 1883.

### 404. NOTROPIS ANOGENUS, Forbes.

Head 4¼; depth 4⅗; eye 3¼. D. 8; A. 7. Lateral line 34 to 37, 13 before dorsal. Teeth 4-4. Very similar to *N. heterodon*, but with the lateral line usually complete; the mouth very small and very oblique, almost wholly anterior; the lower jaw included, the upper lip above level of pupil; snout very short, blunt, shorter than eye. Dusky; a dusky lateral band through eye, ending in a faint black spot at base of caudal; a black speck above each pore of lateral line; chin black. Length $1\frac{1}{2}$ inches. Western New York, (Cayuga Lake; Meek) to Northern Illinois; rather scarce. (ά, without; γένυς, chin.)

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*The types of this species are now in the British Museum. Our friend, Dr. Boulenger, writes us the mouth is of moderate size, the premaxillary extending to below front of eye; lower jaw not included, as long as the upper, which is somewhat convex, about as long as the moderate eye. Chin not black.

*Notropis anogenus*, FORBES, Bull. Ill. Lab. Nat. Hist., 1885, 138, Fox River, McHenry, Illinois. (Coll. Forbes.)

### 405. NOTROPIS CAYUGA, Meek.

Head $4\frac{1}{6}$; depth $4\frac{1}{2}$; eye $3\frac{1}{2}$. Scales 36, 14 before dorsal. Teeth 4–4. Allied to *N. heterodon*, from which it may be best known by the absence of black on the chin. Lateral line wanting on some scales; mouth very small, anterior, the maxillary not reaching the eye; jaws subequal; eye large, equal to snout. Scales above dark-edged, the outlines very sharply defined; chin not black; a black stripe through snout and eye, a dusky lateral shade and a small caudal spot. Length $2\frac{1}{2}$ inches. Cayuga Lake and northern New York, westward to Assiniboina, South Dakota, Nebraska, Kansas, and Arkansas, (Arkansas River at Wichita, Kansas). Not rare, but hitherto usually confounded with *N. heterodon*.

*Notropis cayuga*, MEEK, Ann. Ac. Nat. Hist. N. Y., 1888, 305, Cayuga Lake, New York, (Coll. Meek); JORDAN, Bull. U. S. Fish. Comm., IX, 1889, 17.

*Notropis heterolepis*,* EIGENMANN & EIGENMANN, American Naturalist, February, 1893, 152, Qu'Appelle River, Fort Qu'Appelle, Canada. (Coll. Eigenmann.)

Represented southwestward by

### 405a. NOTROPIS CAYUGA ATROCAUDALIS, Evermann.

Head $4\frac{2}{5}$; depth $4\frac{2}{3}$; eye $3\frac{1}{5}$. D. 8; A. 7; scales 7–36–4, 13 before dorsal. Snout somewhat longer; lateral line complete. Body moderately elongate; head short and bluntly conic; snout slightly shorter than eye; caudal peduncle short and deep; origin of dorsal slightly behind ventrals; anal small. Olivaceous, dotted above, not crosshatched; a black lateral band half width of eye, ending in a black caudal spot, this band extending through eye and snout. Rio Neches, Palestine, Texas. Also in Rio Comal at New Braunfels, Texas. (*ater*, black; *cauda*, tail.)

*Notropis cayuga atrocaudalis*, EVERMANN, Bull. U. S. Fish Comm., XI, 1891, 76, (May 25, 1892,) Neches River, Palestine, Texas. (Type, No. 45557. Coll. Evermann, Scovell, & Gurley.)

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* The following is the description given of *Notropis heterolepis*: D. 9; A. 9. Scales 5–35–4, 15 scales before the dorsal. Teeth 4–4. Dorsal inserted equidistant between base of upper caudal rays and anterior margin of eye, behind last ray of dorsal; scales loosely imbricated, almost embedded in front of dorsal; scales along the median line with a deep notch near middle of posterior margin; the line nearly straight; a few black specks along base of anal, a dark line from anal to caudal; a dark band from tip of snout along sides to caudal; a conspicuous black curved line at base of each scale of lateral line; all the scales above lateral band dotted with black; a narrow vertebral line from occiput to dorsal, a broad dusky band on back between dorsal and caudal, between this and lateral band a lighter band; scales of back with dark markings; series of minute black dots along each ray of dorsal, anal, and anterior portion of pectoral; dorsal and caudal quite dark.—*Eigenmann.*

Dr. Eigenmann has omitted to describe the mouth of this species. According to Dr. G. A. Boulenger, who has kindly examined the type in the British Museum, the mouth is quite small, moderately oblique, the lower jaw not included; premaxillary extending to below anterior nostril; chin not black. Eye very large, longer than the short, convex snout. Only one specimen (35 mm. long) known. Apparently not different from *Notropis cayuga*. (ἑτερός, various; λεπίς, scale.)

### 406. NOTROPIS HETERODON[*] (Cope).

Head 4; depth 4; eye 3 in head. D. 8; A. 8; scales 5–36–3, the lateral line extending about half length of body; teeth 4–4, (sometimes 2, 4–4, 2, see below), often crenate. Body moderately stout, the back somewhat elevated. Head rather pointed, the muzzle acuminate. Mouth oblique; lower jaw projecting; upper lip opposite upper rim of pupil. Maxillary extending to opposite front of orbit. Thirteen scales in front of dorsal. Lateral line usually more or less imperfect. Color olivaceous; chin black; a blackish rostral band; sides with a leaden or dusky band. Length 2½ inches. New York to Michigan and Kansas, common. Variable. (ἕτερος, varying; ὀδούς, tooth.)

*Alburnops heterodon*, Cope, Proc. Ac. Nat. Sci. Phila., 1864, 281, Lansing; Grosse Isle, Michigan.

*Notropis germanus*, Hay, Proc. U. S. Nat. Mus., 1887, 252, Smoky Hill River, Wallace, Kansas. (Type, No. 37949. Coll. Hay.)

*Notropis heterodon*, var., Gilbert, Proc. U. S. Nat. Mus., 1884, 207, Switz City, Indiana, tributary of White River. (Coll. Gilbert.)

*Hybopsis heterodon*, Cope, Cypr. Penn., 382, 1866.

*Leuciscus heterodon*, Günther, Cat., vii, 261, 1868.

*Hemitremia heterodon*, Jordan & Gilbert, Synopsis, 163, 1883.

### Subgenus ALBURNOPS, Girard.

### 407. NOTROPIS FRETENSIS (Cope).

Head 4; depth 5; eye 3½ in head, as long as snout. D. 8; A. 8; scales 6–35–3; teeth 4–4. Body slender and compressed. Mouth quite oblique, the middle of the premaxillary being opposite line of pupil; maxillary not reaching to orbit. Seventeen rows of scales in front of dorsal. Lateral line decurved. Olivaceous; a dark median dorsal band; a plumbeous silvery lateral shade; cheeks silvery; a dark spot at base of caudal; fins plain. Length 2½ inches. Detroit River, Michigan. (Cope.) A doubtful species, perhaps identical with *Notropis cayuga*. (*fretensis*, inhabiting fretum or straits, i. e. Detroit River.)

*Hybopsis fretensis*, Cope, Cypr. Penn., 382, 1866, Detroit.

*Cliola fretensis*, Jordan & Gilbert, Synopsis, 167, 1883.

### 408. NOTROPIS BLENNIUS (Girard).

(Straw-colored Minnow.)

Head 4; depth 5; eye large, 3 in head. Scales 5–36 (32 to 38)–4; teeth 4–4. Body moderately stout, little compressed. Head rather broad, with rounded angles. Mouth small, inferior, horizontal; snout very obtuse;

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[*] *Notropis heterodon* is apparently subject to large variations. The following description is taken from specimens referred by Dr. Gilbert to this species, although there is a possibility that the form in question is really distinct and allied to *N. xænocephalus*:

Head 4; depth 4⅔. D. 8; A. 7; lateral line 37, 13 scales before dorsal; teeth 2, 4–4, 2, with strong grinding surface, the edge of some teeth denticulate. Body slender, compressed, the form and appearance as in *N. heterodon*. Head small, the snout short and rather sharp, slightly decurved. Mouth small, oblique, the maxillary barely reaching front of eye, 4 in head; snout 4; eye very large, 3 in head. Dorsal inserted just before ventrals; pectorals not reaching ventrals. Lateral line complete, little decurved; scales not crowded. Dark olive above, the scales with dark edges; a dusky streak along sides, ending in a spot at base of caudal, this streak extending forward around snout; dark specks along pores of lateral line; a row of specks along base of anal; fins unmarked. Length 2 inches. Sluggish streams of Indiana and Illinois. This description taken by Dr. Gilbert from specimens from Switz City Swamp, Indiana. Differs from the ordinary *heterodon* in the number of teeth and in the complete lateral line.

15 rows of scales in front of dorsal. Dorsal low, its longest ray $\frac{3}{4}$ head. Pale olivaceous; sides usually pale; usually a darker dorsal band and a small dark blotch before dorsal, sometimes a plumbeous lateral stripe but no caudal spot; fins all plain. Length 2 to $2\frac{1}{2}$ inches. Ohio and Michigan to Tennessee, Dakota, and Kansas, thence southwestward to Texas; generally abundant in small streams; an insignificant little fish. Very variable and running into several varieties, the typical *blennius* (= *deliciosus* = *missuriensis*), Missouri to Texas, having the scales usually 32 to 35; var. *stramineus*, from Ohio to Iowa and southward with scales 34 to 38, usually 36. We follow Dr. Meek in identifying Girard's *Alburnops blennius* with this species. (*blennius*, blenny, from the convex profile.)

*?Minnilus microstomus*,[*] Rafinesque, Ichth. Oh., 47, 1820, Ohio River; not certainly identifiable.

*?Hybopsis dorsalis*,[†] Agassiz, Amer. Journ. Sci. Arts, 1854, 358, Burlington, Iowa; unidentifiable.

*Alburnops blennius*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 194, Arkansas River near Fort Smith, Arkansas. (Coll. Shumard.) Girard, Pac. R. R. Surv., x, 261, pl. 57, figs. 13–16, 1858.

*Moniana deliciosa*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 199, Leon River, a tributary of the San Antonio River, Texas. (Type, No. 119. Coll. Kennerly.)

*Hybognathus stramineus*, Cope, Proc. Ac. Nat. Sci. Phila., 1864, 283, Detroit River, Grosse Isle.

*Hybopsis missuriensis*, Cope, Hayden's Surv. Wyoming for 1870 (1871), 437, Missouri River, St. Joseph, Missouri.

*Notropis reticulatus*, Eigenmann & Eigenmann, Amer. Nat., February, 1893, 152, Fort Qu'Appelle, Assiniboia. (Coll. Eigenmann.)

*Hybopsis stramineus*, Cope, Cypr. Penn., 381, 1866.

*Cliola straminea*, Jordan & Gilbert, Synopsis, 167, 1883.

*Cliola missuriensis*, Jordan & Gilbert, Synopsis, 168, 1883.

*Minnilus blennius*, Jordan & Gilbert, Synopsis, 193, 1883.

### 409. NOTROPIS SABINÆ, Jordan & Gilbert.

Head $3\frac{4}{5}$; depth $4\frac{2}{3}$; snout $3\frac{2}{5}$ in head, as long as eye. D. 8; A. 7; scales 4–33–2; teeth 4–4, hooked, with some grinding surface. Allied to *Notropis blennius*, but quite different in form, resembling a young *Moxostoma*. Body robust, the tail long and thick, the back elevated, the sides little compressed. Head long, broad and flattish above. Mouth rather large, nearly horizontal, the maxillary reaching past front of pupil. Scales very large, those on back not reduced, 14 before dorsal. Dorsal inserted nearly over ventrals, the fin short and small; anal small; pectorals long, 1¼ in head. Color very pale olive, scarcely silvery; edges of scales with dark points; fins pale. Length 2 inches. Sabine River, Texas.

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[*] "Thirty-eighth species, Little-mouthed Minny, *Minnilus microstomus*, Minny microstomus. Diameter one-seventh of total length; silvery, olivaceous on the back and head, sides with a few black dots, lateral line straight, pectoral fins reaching the abdominal fins. Dorsal and anal fins with 8 rays. A small species found in the Kentucky River. Mouth very small, nostrils large, iris silvery, fins fulvous, the pectoral with 12 and the caudal with 24 rays. Head elongated."—*Rafinesque.*

[†] "While these pages were setting in type, I have received another pretty species of this interesting genus, through the attention of Dr. I. H. Rauch, from Burlington, Iowa. The large number of specimens obtained enables me to make some additions to the characteristics of the genus:

The mouth is protractile downwards, after the fashion of Catostomus, so much so that had I not ample opportunity to examine young Catostomi, and to study the changes they undergo with age, I might have supposed my *Hybopsis* to be the young of some species of that genus. Moreover the lips are not swollen nor thickened. The pharyngeal teeth differ also greatly from those of Catostomi, there being only 4 or 5 compressed and hooked ones in each main row, and 1 or 2 in a second row.

This new species differs from that of Huntsville by its smaller size, its more pointed snout, and the peculiar coloration. A deep black narrow band extends from the neck to the base of the caudal along the whole back, dividing in advance of the dorsal to encircle that fin, and uniting again behind it upon the middle line. General color olive, silvery upon the sides, the dorsal and caudal faintly tinged with rose color and a deeper rose-colored spot upon the base of the first ray of the dorsal. I shall call this species *H. dorsalis*, Ag."—*Agassiz.*

*Notropis sabinæ*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1886, 15, Sabine River, at Longview, Texas. (Type, No. 36484. Coll. Jordan & Gilbert.)

### 410. NOTROPIS VOLUCELLUS (Cope).

Head 3¾; depth 4; eye 3⅓ in head. D. 8; A. 8; scales 4-34-3; teeth 4-4. Body moderately stout. Head depressed, the snout rather long. Fins more elongate than in most related species, the pectorals reaching ventrals. Caudal peduncle slender. Olivaceous, a slight dusky lateral shade; no dorsal stripe; fins plain. Length 2½ inches. Michigan, Wisconsin, and Northern Indiana; rare. Similar to *N. blennius*, but with notably higher fins, and probably a distinct species. (*volucella*, a diminutive, from *volucer*, winged or swift.)

*Hybognathus volucellus*, Cope, Proc. Ac. Nat. Sci. Phila., 1864, 283, Grosse Isle, Detroit River.
*Hybopsis volucellus*, Cope, Cypr. Penn., 381, 1866.
*Leuciscus volucellus*, Günther, Cat., VII, 260, 1868.

### 411. NOTROPIS SCYLLA (Cope).

Head 4; depth 4¼; eye large, about 3⅓ in head, longer than snout, which is 4. D. 7; A. 7; lateral line 31 to 33; teeth 4-4, with narrow grinding surface. Allied to *N. blennius*, but with stouter body and shorter, blunter head; mouth small, with subequal jaws, the cleft somewhat oblique; lips rather thick. Scales larger than in *N. blennius*, those before dorsal smaller and more crowded, 14 or 15 in number. Maxillary as long as eye. Dorsal fin beginning directly over ventrals. Color pale; back greenish; side with a silvery band; no spots on fins; a dusky shade on each side of dorsal and before it; some dark dots on snout; often a faint dark lateral shade. Length 2¾ inches. Illinois River to Western Kansas and Montana, abundant in the shallow sandy streams of the plains. (Reference unexplained.)

*Hybopsis scylla*, Cope, Hayden's Geol. Surv. Wyom. for 1870, 1871, 438, Red Cloud Creek, tributary of Platte River.
? *Alburnus lineolatus*,[*] Agassiz in Putnam, Bull. Mus. Comp. Zoöl., 1863, 9, Osage River, Missouri; unidentifiable.
*Cliola chlora*, Jordan, Bull. Hayden's Geol. Surv. Terr., IV, 791, 1878, Upper Missouri region. (Type, No. 20193. Coll. Dr. E. Coues.)
*Notropis phenacobius*,[†] Forbes, Bull. Ill. Lab. Nat. Hist., 1885, 137, Illinois River at Peoria, Illinois. (Coll. Forbes.)
*Cliola lineolata* and *Cliola chlora*, Jordan & Gilbert, Synopsis, 169, 1883.
*Notropis lateralis*, (*lapsus* for *lineolatus*), Gilbert, Bull. Washburn Coll. Lab., 1886, 207.

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[*] "*Alburnus lineolatus*, Agassiz, MS. 1854. Body light brown with a broad silvery band having dark points, extending from the head to the caudal fin. Average length, 2½ inches. From the Osage River. Collected by Mr. G. Stolley."—*Putnam.*

[†] The following description of this species is given by Prof. Forbes:

*Notropis phenacobius.*—This fish unites with a strong general resemblance to *Phenacobius* the characters of *Notropis.* The body of the adult is short and deep, the head square, the nose long, and the eye unusually large. Length 2.5 inches, depth 3.5 to 4; caudal peduncle 4 to 4.75. Color in alcohol indefinite; sides somewhat silvery, scales along and above the lateral line slightly specked with black. The head is quadrate in transverse section, flat above, 3.75 to 4; nose decurved, 3.4 to 3.5; interorbital space 2.9 to 3.1. The mouth is inferior, horizontal, rather small, lips fleshy, not lobed, lower jaw much the shorter, 2.75 to 3.1 in head, upper lip opposite the lower margin of the pupil, upper jaw to posterior margin of nostrils, 3.33 to 3.9 in head. Teeth 4-4. Intestine about equal to head and body, 0.97 to 1.17. Eye very large, circular, placed high up, 3.4 to 3.5 in head. Branchiostegals free from isthmus. Dorsal I-8, decidedly before ventrals, its length 7 to 8 in body; anal low, I-8; paired fins rather broad and short; ventrals not reaching vent, and pectorals falling far short of ventrals, the former 6.25 to 6.4 in head and body. The scales are thin, large, crowded anteriorly upon the sides, breast wholly naked in all the specimens seen. Lateral line 35 to 36, longitudinal rows 7 to 9, 13 to 14 before dorsal. Described from 10 specimens, the only ones seen, all taken at Peoria.

### 412. NOTROPIS PROCNE (Cope).

Head 4¾; depth 5¼. Scales 5–32 to 34–3; teeth 4–4; A. 7. Body slender, with long caudal peduncle; the back higher and the tail slenderer than in *N. blennius*, the profile steeper. Snout obtuse, the mouth horizontal, inferior, small. 13 rows of scales in front of dorsal. Dorsal higher than in *N. blennius*, its first ray as long as head. Eye large. Olivaceous; a dark dorsal line and a plumbeous lateral band overlying black pigment; fins unspotted, sometimes very pale. Length 2½ inches. Delaware River and southward, in coastwise streams, as far as the Neuse; very common. One of the smallest of the *Cyprinidæ*. (*πρόκνη*, a kind of swallow.)

*Hybognathus procne*, COPE, Proc. Ac. Nat. Sci. Phila., 1864, 279, Delaware River, Schuylkill River, Conestoga River, White Clay Creek, Pennsylvania.

*Hybopsis longiceps*, COPE, Journ. Ac. Nat. Sci. Phila., 1868, 231, Head waters of James River and Roanoke River, Virginia. (Coll. Cope.)

*Hybopsis procne*, COPE, Cypr. Penn., 385, 1866.

*Leuciscus procne*, GÜNTHER, Cat., VII, 260, 1868.

*Cliola microstoma* and *C. procne*, JORDAN & GILBERT, Synopsis, 168, 169, 1883.

### 413. NOTROPIS NIGROTÆNIATUS (Günther).

Head 4⅓; depth 5; eye 4½. D. 8; A. 8; scales 6–35–3; teeth probably 4–4, although only 2-2 are present in one of the typical examples, and no teeth at all in the others, no evident grinding surface. Body oblong; snout obtuse, convex, longer than the eye. Mouth subinferior, small, the upper jaw the longer; maxillary not reaching front of orbit. Silvery, with black lateral band; no spots on fins. Length 4 inches. Atlisco, Mexico. (*niger*, black; *tæniatus*, striped.)

*Graodus** *nigrotæniatus*, GÜNTHER, Cat., VII, 485, 1868, Atlisco, Mexico. (Coll. Boucard.)

*Cliola nigrotæniata*, JORDAN, Proc. U. S. Nat. Mus., 1879, 226; JORDAN & GILBERT, Synopsis, 164, 1883.

### 414. NOTROPIS KANAWHA, Jordan & Jenkins.

Head 4⅖; depth 4⅗; eye 3½; snout 3½. D. 8; A. 9; scales 4–37–2, 16 before dorsal; teeth 4–4, hooked, with grinding surface. Body rather elongate, moderately compressed, the back a little elevated. Snout bluntish, gently decurved; jaws equal; mouth rather oblique, the maxillary 3 in head, reaching front of eye; interorbital space flattish, slightly broader than eye which is large, preorbital broad; suborbitals narrow; fins all rather high; dorsal inserted distinctly behind ventrals. Translucent green, sides silvery, with few dark dots; no spot on fins or at base of caudal. Length 3½ inches. Tributaries of Kanawha River, southwestern Virginia.

*Notropis kanawha*, JORDAN & JENKINS, Proc. U. S. Nat. Mus., 1888, 354, pl. XLIV, fig. 5, Reed Creek, Wytheville, Virginia. (Type, No. 39928. Coll. Jordan, Evermann, & Jenkins.)

### 415. NOTROPIS BRAYTONI, Jordan & Evermann, new specific name.

Head 3⅔; depth 3¾. D. 8; A. 7; scales 5-32–4. Body stout, rather deep; eye smallish, 3⅓ in head; about equal to snout and about ⅕ less than interorbital area, which is quite flat; margin of upper lip on level of pupil;

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*The accidental loss of the teeth in two of the three typical examples was the occasion of the establishment of the nominal genus, *Graodus*.

mouth rather large, oblique; snout little pointed; maxillary reaching slightly past front of orbit, its length about 3⅙ in head; lower jaw shorter than upper, included; origin of dorsal slightly nearer tip of snout than base of caudal; about 12 scales in front of dorsal; tips of dorsal rays all coterminous when the fin is deflexed; length of longest ray 1½ in head; base of fin scarcely 2 in head; anal similar to dorsal, its longest ray 2 in head; base 3; pectorals reaching ¾ distance to ventrals, 1⅔ in head; ventrals reaching ⅔ distance to anal, 1⅔ in head; teeth 4–4, little hooked. Color brownish, a faint silvery band along sides, little wider than eye, a very small faint dark spot at base of caudal; fins all plain. Tributaries of Rio San Juan, at Cadereita, and Nuevo Leon. Allied to *N. blennius*, but differing in the larger, more oblique mouth. (Named for Dr. Alembert Winthrop Brayton, of Indianapolis, with pleasant memories of our explorations in Georgia and the Carolinas in 1877 and 1878.)

*Moniana nitida*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 21, Cadereita, Mexico. (Type, No. 39657. Coll. Couch.) (Not *Alburnus nitidus*, KIRTLAND, also a *Notropis.*)

### 416. NOTROPIS SPECTRUNCULUS (Cope).

Head 4; depth 5½; eye 3. D. 8; A. 9; lateral line 37; teeth 4–4. Body elongate. Head large, rather flat, nearly as broad as deep. Muzzle thick. Mouth slightly oblique, maxillary reaching eye; 15 rows of scales in front of dorsal. Pale olive, silvery white below; a leaden band along the sides and a conspicuous black spot at base of caudal; head dusky; margins of scales above lateral line, as well as bases of dorsal and anal fins, blackish; pectorals, ventrals, dorsal, and anal more or less orange in life; no red on snout. Length 3 inches. Head waters of Tennessee River, in Tennessee, Virginia, and North Carolina; abundant in cold mountain streams and springs. A well-marked species. (Diminutive of *spectrum*, an image.)

*Hybopsis spectrunculus*, COPE, Journ. Ac. Nat. Sci. Phila., 1868, 231, Bear Creek, tributary of Middle Fork of Holston River. (Coll. Cope.)
*Cliola spectruncula*, JORDAN & GILBERT, Synopsis, 166, 1883.

### 417. NOTROPIS OZARCANUS, Meek.

Head 4½; depth 6½; eye 3. D. 7; A. 8; scales 36; teeth 4–4, hooked, with narrow grinding surface, their edges crenate. Allied to *N. spectrunculus*, but with slenderer body and head. Body little compressed. Mouth small, little oblique, maxillary not quite to eye; lips very thin; preorbital large; pectoral short. Olivaceous, sides with dark dots forming a faint lateral band. White River, Arkansas, in the Ozark Mountains.

*Notropis ozarcanus*, MEEK, Bull. U. S. Fish Comm., IX, 1889 (1891), 129, North Fork of White River, Arkansas. (Coll. Meek & Drew.)

### 418. NOTROPIS CHIHUAHUA, Woolman.

Head 4; depth 4; eye large, 3¾ in head, slightly longer than snout. D. 8; A. 7; scales 33 to 37; teeth 4–4, hooked, with very narrow grinding surface. Body rather plump, little compressed, the back little elevated; head large; snout blunt; mouth slightly oblique, the maxillary scarcely reaching eye; front of dorsal midway between snout and caudal; scales deeper than long; lateral line straight, complete. Light brown, scales above dark-edged; numerous round dark dots above, the largest sometimes nearly size of pupil, the spots unequal and irregularly placed, much as in *Hybopsis æstivalis*, or *H. hyostomus*; a plumbeous lateral stripe from eye through snout, ending in a black spot at base of caudal; fins plain. Rio de los Conchos, Chihuahua; locally abundant.

*Notropis chihuahua*, Woolman, Amer. Nat., March, 1892, 260, Rio de los Conchos, Chihuahua, Mexico. (Type, No. 44151. Coll. Woolman & Cox.)

### 419. NOTROPIS TOPEKA, Gilbert.

Head 4; depth 3⅗; eye 4⅕. D. 8; A. 7; scales 5–35–4. Body compressed, stout and chubby; snout blunt; mouth small, terminal, oblique; 14 scales before dorsal; lateral line anteriorly decurved. Olivaceous, a dusky lateral streak ending in a small caudal spot; males in spring and summer with sides and lower fins bright red or orange. Length 2¾ inches. Western Iowa and eastern South Dakota, (Evermann), to Kansas; locally abundant in the prairie streams. A well-marked species, apparently allied to the group called *Codoma*.

*Notropis topeka*, Gilbert, Bull. Washburn Lab. Nat. Hist., Topeka, 1884, I, 13, tributary of Kansas River, Topeka, Kansas. (Type, No. 36609. Coll. Cragin.)
*Notropis æneolus*, Hay, Proc. U. S. Nat. Mus., 1887, 245, Solomon River, Wa Keeney, Kansas. (Type, No. 37945. Coll. Hay.)

## Subgenus HUDSONIUS, Girard.

### 420. NOTROPIS GILBERTI, Jordan & Meek.

Head 4; depth 5; eye moderate, about 3½. D. 8; A. 9; scales 5–35–4. Slender, with long tail; head long, flattish above; snout moderate; mouth rather large, little oblique, the lower jaw included. Lips a little thickened, especially near angle of mouth. 17 scales before dorsal, which is inserted slightly behind ventrals. Light olive; sides with dusky streaks and dark specks. Length 2½ inches. Eastern Iowa to eastern Colorado, abundant in muddy streams of the plains, from the Des Moines River to the Platte. (Named for Dr. Charles Henry Gilbert, joint author of the "Synopsis of the Fishes of North America.")

*Notropis gilberti*, Jordan & Meek, Proc. U. S. Nat. Mus., 1885, 4, Des Moines River and Village Creek, Ottumwa, Iowa. (Type, No. 35840?. Coll. Jordan & Meek.)

### 421. NOTROPIS PIPTOLEPIS (Cope).

Head 4; depth 4⅓; eye 3½. D. 7; A. 8; scales 6–36–4; teeth 1, 4–4, 1. Physiognomy of *Hybopsis dissimilis*. Body elongate, not elevated. Head elongate. Mouth small, nearly horizontal, the maxillary reaching beyond line of orbit, the mandible somewhat projecting. Region in front of dorsal fin more or less bare of scales. Dorsal beginning opposite ventrals, nearer snout than base of caudal. Olivaceous; silvery below; a broad, silvery lateral band, with dark specks; sides of head with black specks; a dark vertebral band. Length 3 inches. North Platte River. (Cope.) A doubtful species, perhaps the same as *N. gilberti*. (πίπτω, to fall; λεπίς, scale.)

*Photogenis piptolepis*, COPE, Hayden's Geol. Surv. Terr. Wyom. for 1870, (1871), 438, Red Cloud Creek, a tributary of North Platte River.
*Cliola zonata*, JORDAN & GILBERT, Synopsis, 183, 1883, (not *Notropis zonatus*).

### 422. NOTROPIS SIMUS (Cope).

Head 4⅕; depth 4⅕; eye 4⅕. D. 8; A. 9; scales 8–35–4, 22 series in front of dorsal fin; teeth 1, 4-4, 1; said to be without grinding surface. Body robust. Head short and broad, with short, decurved muzzle. Mouth large, oblique, upper lip below level of pupil, maxillary extending past front of orbit. Fins large, the dorsal well behind ventrals. Coloration entirely silvery, brightest on sides. Length 3½ inches. Rio Grande at at San Ildefonso, New Mexico. (Cope.) (*simus*, *σιμός*, snubnosed.)

*Alburnellus simus*, COPE, Zoöl. Wheeler Surv., v, 649, 1875, (1876), San Ildefonso, New Mexico. (Type, No. 16982. Coll. Yarrow.)
*Cliola sima*, JORDAN & GILBERT, Synopsis, 170, 1883.

### 423. NOTROPIS LONGIROSTRIS (Hay).

Head 4¼; eye 4. D. 8; A. 7; scales 4–36–3; teeth 1, 4–4, 0 or 1,[*] with grinding surface. Form of *Ericymba buccata*. Head rather small; eye shorter than the blunt snout. Upper jaw rounded, considerably projecting beyond lower. Mouth rather large, horizontal; maxillary extending to front of eye. Scales large; about 12 large scales in front of dorsal. Origin of dorsal midway between tip of snout and base of caudal, directly over ventrals. Pectorals not reaching ventrals; the latter to vent. Straw color, with an obsolete lateral band and a narrow dorsal streak; fins dusky. Chickasawha River, Mississippi, to Escambia River, Florida. (*longus*, long; *rostrum*, snout.)

*Alburnops longirostris*, HAY, Proc. U. S. Nat. Mus., 1880, 504, Chickasawha River at Enterprise, Mississippi. (Type, Nos. 27440 and 32267. Coll. Hay.)
*Cliola longirostris*, JORDAN & GILBERT, Synopsis, 167, 1883.
*Notropis longirostris*, GILBERT, Bull. U. S. Fish Comm., IX, 1889, 158.

### 424. NOTROPIS NUX, Evermann.

Head 4; depth 4½; eye large, 3 in head, equal to snout, and to interorbital width. D. 8; A. 7; scales 6–37–3, 13 before dorsal; teeth 1, 4–4, 1 or 0, rarely 1, 4–4, 2, the grinding surface developed and a little crenate. Body slender, the back somewhat elevated; head subconic, the snout rather blunt; mouth moderate, oblique; maxillary not reaching orbit; lower jaw slightly included; caudal peduncle long and slender. Dorsal inserted over ventrals, the longest rays as long as head; anal small; pectorals short, not to ventrals; caudal long; lateral line straight, complete. Greenish, the back with crosshatching of dark specks; a dark vertebral streak; a plumbeous lateral band, ending in a small, but distinct, caudal blotch, this band extending across opercles, eye, and snout; fins plain. Known only from Neches and Trinity rivers, near Palestine, Texas. (*nux*, nut; in Spanish, *neche*.)

*Notropis nux*, EVERMANN, Bull. U. S. Fish Comm., XI, 1891, (May 25, 1892), 77, Neches and Trinity rivers, Palestine, Texas. (Type, No. 45555. Coll. Evermann, Scovell, & Gurley.)

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[*] According to Dr. Gilbert; Dr. Hay found the teeth 4–4.

### 425. NOTROPIS NOCOMIS, Evermann.

Head 4⅓; depth 4¾ to 5; eye large, 3 to 3¼ in head, equal to interorbital width. D. 8; A. 8; scales 6–36–3; teeth 1, 4–4, 1, small, hooked, the grinding surface narrow, slightly crenate. Body slender, little elevated; head heavy, formed as in *Cliola vigilax*; snout blunt and rounded, equal to eye; mouth small, inferior, horizontal; lower jaw included; maxillary short, not nearly reaching orbit; preorbital broad; caudal peduncle long and slender. Dorsal high, inserted over ventrals; pectorals short, not to ventrals; lateral line complete. Yellowish, with crosshatching of dark specks above; a dark lateral band, faint anteriorly; no caudal spot; fins plain. Length 2½ inches. Trinity, San Marcos, and Comal rivers, Texas; locally abundant. (*Nocomis*, an Indian name, applied by Girard to a group of fishes here regarded as a subgenus under *Hybopsis*.)

*Notropis nocomis*, EVERMANN, Bull. U. S. Fish Comm., XI, 1891, (May 25, 1892), 78, Trinity River, Palestine, Texas, and San Marcos River, San Marcos, Texas. (Type, No. 45556. Coll. Evermann, Scovell, & Gurley.)

### 426. NOTROPIS SHUMARDI (Girard.)

Head 3¾; depth 4⅕; eye very large, 2⅓ to 3 in head. A. 7; scales 5–36–2; teeth 1, 4–4, 1, (2, 4–4, 2, according to Girard), with deep grinding surface, and the edge strongly crenate. Body compressed, the back elevated; tail slender; snout short, not blunt; mouth terminal, very oblique; lower jaw included; maxillary reaching front of eye; dorsal inserted over ventrals; 12 scales before dorsal. Olivaceous, sides with dusky streaks and dark specks. Length 3 inches. Ohio and Tennessee basins to Iowa and the Ozark region, in cold streams and springs; abundant in Arkansas, and in northern Alabama. (Named for Dr. George C. Shumard, naturalist on the Mexican Boundary Survey.)

*Alburnops shumardi*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 194, Arkansas River, Fort Smith, Arkansas. (Coll. Shumard.)

*Notropis boops*, GILBERT, Proc. U. S. Nat. Mus., 1884, 201, Salt Creek, Brown County, Indiana, and Flat Rock Creek, Decatur County, Indiana. (Type, No. 34982. Coll. Gilbert.)

*Minnilus shumardi*, JORDAN & GILBERT, Synopsis, 194, 1883.

*Minnilus scabriceps*, JORDAN & GILBERT, Synopsis, 194, 1883, not of Cope.

### 427. NOTROPIS ILLECEBROSUS (Girard).

Head 4⅓; depth 4⅓; eye 3⅙; snout 3⅔. D. 8; A. 8; scales 7–35–3, 11 before the dorsal; teeth 1, 4–4, 1, slightly hooked, with slight grinding surface. Body rather deep, compressed, caudal peduncle deep, its least depth 2⅕ in head. Mouth large, oblique, maxillary reaching eye; lower jaw included; eye large, greater than snout; interorbital width equal to snout; width of lower jaw at base 1½ in eye. Origin of dorsal very little behind insertion of ventral fins, a little nearer snout than base of caudal. First rays of dorsal somewhat produced, their length greater than that of head; free margin of dorsal very slightly concave in the expanded fin; base of fin 1⅗ in longest ray. Longest anal ray 1⅓ in head. Pectorals equal longest dorsal ray. Pale straw color, side with a broad silvery band following course of lateral line; sides of head silvery. Length 3 inches. Description here drawn up from the types. Lower Arkansas River basin, probably not distinct from *Notropis shumardi*. (*illecebrosus*, enticing.)

*Alburnops illecebrosus*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 194, Arkansas River, Fort Smith, Arkansas. (Type No. 66. Coll. Dr. Shumard); Girard, Pac. R. R. Surv. x, 262, pl. 57, figs. 5–8, 1858.
*Minnilus shumardi*, Jordan & Gilbert, Synopsis, 192, 1883 (in part).

### 428. NOTROPIS HUDSONIUS (DeWitt Clinton).

(Spawn-eater; Spot-tailed Minnow; Shiner.)

Head 4¾; depth 4; eye 3. D. 8; A. 8; scales 5–39–4; teeth 1, 4–4, 0 or 1, or 2. Body elongate, considerably compressed in the adult. Head quite short. Muzzle blunt, decurved, shorter than the very large eye. Mouth moderate, nearly horizontal, the jaws nearly equal, the maxillary nearly reaching to the eye. Lateral line nearly straight, slightly decurved anteriorly. 18 scales before dorsal. Pectorals not reaching ventrals, the latter not to vent. Coloration very pale, with usually a dusky or black spot at base of caudal, especially in the young; sides with a broad, silvery band, which is sometimes dusky. Length 4 to 6 inches. The Dakotas and Lake Superior to New York, and southward to South Carolina; abundant in the Great Lakes, and not rare east of the Alleghany Mountains; a large and handsome minnow, the choice "live bait" of the St. Lawrence River angler. The typical form, *hudsonius*, in the Lower Great Lakes and the Hudson, Susquehanna, and other northeastern rivers, has the head short, 4⅔ in length; eye 3⅖ in head, as long as the blunt snout; mouth less oblique than in *selene*, more so than in *amarus*; maxillary not reaching front of eye; caudal spot jet-black. Teeth 2, 4–4, 1. Specimens apparently referable to *hudsonius* rather than to *amarus* occur in the Potomac, and in streams even so far south as South Carolina, but the boundaries of *hudsonius*, *amarus*, and *saludanus* are hard to fix.

*Clupea hudsonia*, DeWitt Clinton, Ann. Lyc. Nat. Hist. N. Y., 1, 49, 1824, Hudson River.
*Hudsonius fluviatilis*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 210, Hudson River. (Type, No. 14. Coll. Baird.)
*Hybopsis hudsonius*, Cope, Cypr. Penn., 386, 1866.
*Leuciscus hudsonius*, Günther, Cat., vii, 250, 1868.
*Cliola hudsonia*, Jordan & Gilbert, Synopsis, 171, 1883.

Represented in Lake Superior by

### 428a. NOTROPIS HUDSONIUS SELENE (Jordan).

With the head very short, 4⅘ in body, the mouth quite oblique, the premaxillary on level of lower part of pupil; snout ⅗ eye; maxillary reaching front of eye. Caudal spot jet-black. Teeth 2, 4–4, 2 or 1. (*σηληνη*, the moon.)

*Luxilus selene*, Jordan, Bull. U. S. Nat. Mus., x, 60, 1877, Lake Superior, Bayfield, Wisconsin. (Coll. Milner.)
*Minnilus selene*, Jordan & Gilbert, Synopsis, 188, 1883.

Southward it gives place to

### 428b. NOTROPIS HUDSONIUS AMARUS (Girard).

Very close to var. *hudsonius*, characterized by the longer and less obtuse head, 4½ to 4⅗ in length, the eye 3½ in head, longer than snout; the caudal spot faint or wanting, and the teeth 1, 4–4, 0. Delaware and Potomac rivers. This is nót unlikely a distinct species, as Abbott has contended, but there is some evidence of its intergradation with *hudsonius*. (*amarus*, bitter, the type from brackish water.)

*Hudsonius amarus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 210, Chesapeake Bay; Potomac River at Washington. (Coll. Girard.)
*Hybopsis phaënna*, COPE, Proc. Ac. Nat. Sci. Phila., 1864, 279, Delaware River, Trenton, New Jersey. (Coll. Cope.)
*Hybopsis storerianus*, COPE, Cypr. Penn., 386, 1866.
*Leuciscus storerianus*, GÜNTHER, Cat., VII, 250, 1868, not *Rutilus storerianus*, KIRTLAND.
*Hybopsis phaënna*, ABBOTT, Amer. Nat., 1874, 333.
*Cliola storeriana*, JORDAN & GILBERT, Synopsis, 170, 1883.

This form gives place still further southward to

### 428c. NOTROPIS HUDSONIUS SALUDANUS (Jordan & Brayton).

Head 4¼; depth 4½; eye large, 3½, (3 to 4). D. 8; A. 8; scales 5–39–3; teeth 1, 4–4, 0, two or three of the teeth obtuse, not hooked, only one or two of them showing a grinding surface. Body elongate, but less so than in var. *hudsonius*; moderately compressed. Caudal peduncle long. Head large, rather heavy and gibbous forward, the muzzle rounded in profile. Mouth moderate, subinferior, the maxillary not reaching eye. Scales large, thin and loose, about 12 in front of dorsal. Lateral line somewhat decurved in front. Fins rather small; pectorals not reaching ventrals, the latter not to vent. Coloration pale olivaceous, nearly white, with traces of a plumbeous lateral streak, this sometimes appearing as a black lateral band, (var. *euryopa*), and sometimes leading to a black caudal spot as in *hudsonius*. Length 4 inches. Coastwise streams from the James to the Ocmulgee. Close to subspecies *amarus* with which it may intergrade. Head notably longer, 4⅙ to 4½, the snout especially longer, as long as eye, projecting beyond the inferior mouth.

*Alburnops saludanus*, JORDAN & BRAYTON, Bull. U. S. Nat. Mus., XII, 16, 1878; tributary of Saluda River, Greenville, South Carolina. (Type, No. 31128. Coll. Jordan & Brayton.)
*Hudsonius euryopa*, BEAN, Proc. U.S. Nat. Mus., 1879, 285, McBean Creek, tributary of Savannah River, Georgia. (Type, No. 23513. Coll. A. Graves.)
*Cliola saludana* and *euryopa*, JORDAN & GILBERT, Synopsis, 170, 171, 1883.

## Subgenus CODOMA, Girard.

### 429. NOTROPIS ORNATUS (Girard).

Head 3¾ to 4; depth 3; eye 3¾ to 4. D. 8; A. 7; scales 7–40–4, those before dorsal large, 17; teeth 4–4. Body stout and compressed, the back arched, the head very blunt, thick and rounded, almost spherical in the male. Mouth small, somewhat oblique, the cleft mostly anterior; the jaws equal. Eye smallish. Scales deep, very closely imbricated, those on sides much higher than long; lateral line decurved. Dorsal a little behind ventrals. Fins all rather small. Snout highly prickly in spring males. Color dark; sides with about 8 to 10 more or less conspicuous crossbars; head mostly black in males; fins all with the middle part dusky or black, the tips milk-white, the ventrals and the anal notably so; females paler, the lateral bars narrower and shorter, the fins with less black. Length 2½ inches. Chihuahua River, our specimens taken in the original locality by A. J. Woolman. (*ornatus*, adorned.)

*Codoma ornata*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 195, Chihuahua River; and U.S. Mex. Bound. Surv., Ichth., 53, pl. 29, figs. 22–25, 1859; this species and *Notropis aztecus* both well figured by Girard. (Type, No. 91. Coll. J. Potts.)
*Cliola ornata*, JORDAN & GILBERT, Synopsis, 173, 1883.

### Subgenus MONIANA, Girard.

### 430. NOTROPIS FORMOSUS (Girard).

Head 3¾; depth 3½; eye 3½. D. 8; A. 8; scales 7–43–4, 23 before dorsal; teeth 4–4. Body elliptic, compressed, the form about as in *N. lutrensis*. Mouth moderate, oblique, the maxillary 3½ in head. Dorsal fin rather high. Sides with a dusky streak, a brown spot at base of caudal. Length 2¼ inches. Rio Mimbres, Chihuahua. Well distinguished from *N. lutrensis* and related forms by the small size of the scales. (*formosus*, comely.)

*Moniana formosa*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 201, Rio Mimbres, Chihuahua.
*Cliola formosa*, JORDAN & GILBERT, Synopsis, 174, 1883.
*Notropis formosus*, JORDAN, Proc. U. S. Nat. Mus., 1885, 125.

### 431. NOTROPIS FRIGIDUS (Girard).

Head 4⅓; depth 3½ to 4; eye moderate, 4 in head. D. 9; A. 9.; lateral line 37. Body moderately elongate, compressed, with long caudal peduncle. Head moderate, the snout subconical, somewhat pointed. Mouth rather large, oblique, the maxillary scarcely extending to orbit. Lateral line decurved. Length 3¼ inches. Rio Frio, Texas; differing from *N. lutrensis* in the smaller scales. (*frigidus*, cold; in Spanish, frio.)

*Moniana frigida*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 200, Rio Frio, Texas. (Type, No. 124. Coll. Clark.)
*Cliola leonina*, JORDAN & GILBERT, Synopsis, 174, 1883, not of Girard.

### 432. NOTROPIS LUTRENSIS (Baird & Girard).

Head 3⅔; depth 3 (adult) to 4; eye small, 4. D. 7 or 8; A. 8; scales 6–35–2; teeth 4–4. Body oblong, elevated, strongly compressed, the back arched; caudal peduncle rather slender. Head stout and deep, its upper outline depressed, the nape elevated, forming an angle, so that the profile is somewhat concave. Young more slender, the form variously elongate or elliptical. Mouth rather large, quite oblique, the lower jaw included. Lateral line strongly decurved. Thirteen scales in front of dorsal. Males profusely tuberculate in spring. Colors in life brilliant, steel-blue; the lower parts silvery; the belly orange-red in the males; a conspicuous violet-colored crescent behind the shoulders, followed by a crimson crescent; fins reddish, the anal and caudal blood-red. Female plain greenish, the fins unspotted. Length 2¾ inches. Southern Illinois to South Dakota

Kansas, and the Rio Grande; very abundant in clear brooks southwestward; a very brilliant and very variable little fish. (*lutra*, the otter; the species was first known from Otter Creek, Arkansas.)

*Leuciscus lutrensis*, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1853, 391, Otter Creek, tributary of North Fork Red River, Arkansas. (Type, No. 104. Coll. Capt. Geo. B. McClellan.)
*Cyprinella suavis*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 197, San Antonio, Texas.
*Moniana lætabilis*, Hurrah Creek, tributary of Rio Pecos; *couchi*, China, New Leon; *rutila*, Cadareita, New Leon; and *gracilis*, Monterey, New Leon, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 199–201. (Type, No. 116. Coll. Couch.)
*Moniana leonina*, Leon River near San Antonio; and *complanata*, Brownsville, Texas, Girard: *l. c.*, 199, are probably the same, though figured with smaller scales.
*Moniana pulchella*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 200, Sugar Loaf Creek, tributary of Poteau River. (Coll. Möllhausen.)
*Moniana gibbosa*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 201, Brownsville, Texas. (Type, No. 31159. Coll. Van. Vliet.)
*Cyprinella billingsiana*, Cope, Hayden's Geol. Surv. Terr. Wyom. for 1870, (1871), 439, St. Joseph, Missouri. (Coll. Dr. Wm. Stimpson.)
*Moniana jugalis*, Cope, Hayden's Geol. Surv. Wyom. for 1870, (1871), 439, St. Joseph, Missouri.
*Hysilepis iris*, Cope, Zoöl. Wheeler Surv., v, 653, 1875, (1876), Rio Grande, San Ildefonso, New Mexico. (Type, No. 16976. Coll. Yarrow.)
*Cyprinella forbesi*, Jordan, Bull. Ill. State Lab. Nat. Hist., ii, 57, 1878, clear streams of southern Illinois. (Type, No. 29867. Coll. Forbes.)
*Cliola montiregis*, Cope, Proc. Amer. Philos. Soc., 1884, 168, Monterey, New Leon.
*Leuciscus lutrensis*, Günther, Cat., vii, 258, 1868.
*Cyprinella complanata*, Jordan, Bull. Hayden's Geol. Surv. Terr., iv, 3, 665, 1878.
*Cliola iris*, Jordan & Gilbert, Synopsis, 172, 1883.
*Cliola jugalis*, Jordan & Gilbert, Synopsis, 172, 1883.
*Cliola gibbosa*, Jordan & Gilbert, Synopsis, 174, 1883.
*Cliola lutrensis*, Jordan & Gilbert, Synopsis, 175, 1883.
*Cliola suavis*, Jordan & Gilbert, Synopsis, 176, 1883.
*Cliola billingsiana*, Jordan & Gilbert, Synopsis, 177, 1883.
*Cliola forbesi*, Jordan & Gilbert, Synopsis, 174, 1883.

### 433. NOTROPIS PROSERPINA (Girard).

Head 3¾; depth 4; eye 4; snout 3½. D. 7; A. 7; scales 6–35–3, 14 before dorsal. Body rather robust; mouth subinferior, nearly horizontal. Brownish above, paler below, but no silvery lateral band; a metallic band of dark points from upper edge of preopercle to upper edge of caudal. Length 2 inches. Rio Grande region. (*Proserpina*, Proserpine, the allusion not evident.)

*Moniana proserpina*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 200, Devil River, Texas. (Type, No. 117. Coll. Clark.)
*Moniana aurata*, Girard, *l. c.*, 200, Piedrapainte, New Mexico. (Type, No. 118. Coll. Clark).
?*Moniana tristis*, Girard, *l. c.*, 1856, 201, locality unknown. (Coll. Beckwith.)
*Cliola deliciosa*, Jordan & Gilbert, Synopsis, 175, 1883.
*Cliola aurata*, Jordan & Gilbert, Synopsis, 175, 1883.
*Notropis proserpina*, Jordan, Proc. U. S. Nat. Mus., 1885, 125.

### 434. NOTROPIS CALLISEMA (Jordan).

Head 4; depth 4⅖; eye 4¼. D. 8; A. 8; scales 6–39–3; teeth 4–4. Body rather elongate, fusiform, compressed. Head elongate, the muzzle rather blunt, projecting over the moderate, oblique mouth; maxillary not reaching to opposite eye. Eye moderate. Scales firm, closely imbricated, 15 in front of dorsal. Dorsal fin extremely high; its height in the males one-fourth length of body, in females somewhat lower; its insertion almost directly over first ray of ventrals. In the other similarly colored species of *Notropis* the dorsal is evidently behind the ventrals. Coloration brilliant, clear dark blue above, sides and below abruptly silvery; a blue lateral streak, much as in *N. cœruleus*, bounding the blue of the upper parts, the white pigment of the lower parts looking as if painted over the blue. Dorsal with a large black spot on its last rays above. Dorsal, anal, and caudal with the usual satin-white pigment at their tips; these fins otherwise of a clear, ferruginous orange. Females slender and dull-colored. Length 2¾ inches. Ocmulgee River, Georgia. An elegant fish. (*καλός*, beautiful; *σῆμα*, sail, from the dorsal fin.)

*Episema callisema*, Jordan, Ann. Lyc. Nat. Hist. N. Y., 1876, 363, South Fork of Ocmulgee River, Flat Shoals, Georgia. (Type, No. 17864. Coll. Jordan & Gilbert.)

*Codoma callisema*, Jordan, Bull. U. S. Nat. Mus., xii, 52, 1878.

*Cliola callisema*, Jordan & Gilbert, Synopsis, 173, 1883.

### Subgenus CYPRINELLA, Girard.

### 435. NOTROPIS BUBALINUS (Baird & Girard).

Head 4⅛; depth 3; eye 4 in head. D. 8; A. 9; scales 32 to 35. Body short, the back arched; head short and deep, blunt in profile; mouth moderate, oblique, the jaws subequal; lateral line decurved. Coloration plain in spirits, the males probably with bright pigment. Length 3½ inches. Streams of Arkansas and westward; not common. (Diminutive of *bubalus*, buffalo.)

*Leuciscus bubalinus*, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1853, 391, Otter Creek, Arkansas. (Coll. Capt. Geo. B. McClellan.)

*Cyprinella beckwithi*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 197, Arkansas River, near Fort Makee. (Coll. Beckwith.)

*Cyprinella gunnisoni*, Girard, *l. c.*, 197; said to be from Cottonwood Creek, Utah, which must be an error, as no *Notropis* is found in Utah. (Type, No. 139. Coll. Kreuzfeld.)

*Cyprinella umbrosa*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 197, and Pac. R. R. Surv., x, 266, 1858, Coal Creek, tributary of South Fork Canadian River. (Type, No. 133. Coll. Möllhausen.

*Cyprinella lepida*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 197, Rio Frio, Texas; may be *lutrensis*; and Pac. R. R. Surv., x, 268, 1858. (Coll. Kennerly.)

*Cyprinella bubalina*, Girard, Pac. R. R. Surv., x, 265, 1858.

*Cliola lepida*, Jordan & Gilbert, Synopsis, 176, 1883.

*Cliola umbrosa*, *bubalina*, and *gunnisoni*, Jordan & Gilbert, Synopsis, 176, 1883.

### 436. NOTROPIS LUDIBUNDUS (Girard).

Head 4; depth 4¾; eye large, 3 in head; snout 4. D. 8; A. 7; scales 4–31–3, 13 before dorsal. Body elongate, subfusiform. Mouth oblique, small, the maxillary extending to eye. Dorsal fin high. Silvery; lateral line with black dots. Length 2 inches; locality unknown, probably Indian Territory. (*ludibundus*, playful.)

*Cyprinella ludibunda*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 199, locality unknown. (Coll. Beckwith.)

*Cliola ludibunda*, Jordan & Gilbert, Synopsis, 177, 1883.

### 437. NOTROPIS MACROSTOMUS (Girard).

Head 4; depth 4⅛. D. 8; A. 9; lateral line 36; teeth 1, 4–4, 1. Body slender, the form approaching that of *N. atherinoides*. Head moderate. Mouth rather larger than in related species, oblique, the maxillary reaching front of eye. Eye large. Lateral line somewhat decurved. Dorsal behind ventrals. Brownish above; cheeks and sides bright silvery. Rio Grande region, northward to Kansas, if *umbrifer* is the same species. (*μακρός*, wide; *στόμα*, mouth.)

*Cyprinella macrostoma*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 198, **Devil River, Texas.** (Type, No. 129. Coll. Clark.)

?*Cyprinella luxoides*, Girard, *l. c.*, 198, **San Pedro Creek, Texas.** (Coll. Kennerly.)

?*Cyprinella lugubris*, Girard, *l. c.*, 199, **locality unknown.** (Coll. Beckwith.)

?*Notropis umbrifer*, Hay, Proc. U. S. Nat. Mus., 1887, 245, **Solomon River at Beloit, and Saline River near Wa Keeney, Kansas.** (Coll. Hay.)

### 438. NOTROPIS TEXANUS (Girard).

Head 4; depth 4½; eye 3 in head. D. 8; A. 8; scales 5–35–4, 15 before dorsal. Body rather slender; snout bluntish; mouth nearly horizontal, the lower jaw slightly projecting. Lateral line nearly straight. Fins moderate. Eye slightly longer than snout, equal to maxillary. Silvery, dark points along lateral line; a small jet-black caudal spot slightly larger than pupil; a row of dark points along base of anal. Length 2 inches. Rivers of Texas from the Trinity to the Salado.

*Cyprinella texana*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 198, **Rio Salado and Turkey Creek, Texas.** (Type, No. 182 (2710). Coll. Clark); Meek, Proc. U. S. Nat. Mus., 1885, 124.

*Notropis texanus*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1886, 17.

### 439. NOTROPIS NOTATUS (Girard).

Head 4; depth 3⅔; eye 3½. D. 8; A. 7; scales 5–35–3. Body stoutish; the caudal peduncle slender. Eye moderate; snout bluntish. Mouth small, oblique, the maxillary not reaching to the eye. Ventrals in advance of dorsal. Fins moderate. Coloration plain in spirits, except the black caudal spot; sides silvery. Streams of Texas, from Austin westward. Allied to *N. venustus*, but the scales larger, and the caudal spot faint and veiled by the scales. (*notatus*, spotted.)

*Cyprinella notata*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 198, **Rio Seco, Texas**; and Pac. R. R. Surv., x, 269, 1858. (Type, No. 136. Coll. Kennerly.)

*Cliola notata*, Jordan & Gilbert, Synopsis, 177, 1883.

### 440. NOTROPIS VENUSTUS (Girard).

Head 4; depth 3¾; eye large, 3⅗; snout 4. D. 7; A. 8; scales 5–31–3, 15 before dorsal; teeth 4–4. Body rather slender. Head long and rather pointed. Mouth oblique, the maxillary reaching front of eye; jaws subequal. Fins moderate; the dorsal behind ventrals. Coloration brownish above; sides silvery; a round black spot as large as eye at base of caudal. Rio Sabinal, Texas. Allied to *N. cercostigma*, but with larger scales; compared with *N. notatus*, the eye is smaller, the mouth more oblique, the snout more pointed and the caudal spot more distinct in *N. venustus*. (*venustus*, beautiful, like Venus.)

*Cyprinella venusta*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 198, Rio Sabinal, Texas, (Coll. Kennerly); and Mex. Bound. Surv., Ichth., 54, 1859.

*Cliola venusta*, Jordan & Gilbert, Synopsis, 178, 1883.

### 441. NOTROPIS CERCOSTIGMA (Cope).

Precisely like *Notropis stigmaturus* except that the scales are larger, 37 to 39 in the lateral line, and the fins in adult males more deeply colored, orange yellow, with milky tips in life. Teeth 1, 4-4, 1. Caudal spot nearly circular. Sandy streams tributary to the Gulf of Mexico, from Pearl River and Red River to Rio Nueces; abundant, especially so in Rio Colorado of Texas. (*κέρκος*, tail; *στίγμα*, spot.)

*Cyprinella cercostigma*, Cope, Proc. Ac. Nat. Sci. Phila., 1867, 157, Pearl River, Monticello, Mississippi.

*Luxilus chickasavensis*, Hay, Proc. U. S. Nat. Mus., 1880, 506, Chickasawha River, Mississippi. (Type, No, 27419. Coll. Hay.)

*Cliola urostigma*, Jordan & Meek, Proc. U. S. Nat. Mus., 1884, 475, San Saba River, Fort McKavit, a tributary of Rio Colorado; Clear Creek, Texas. (Type, Nos. 20446 and 17812. Coll. Anderson, Kumlein, & Earll.)

*Minnilus cercostigma*, Jordan & Gilbert, Synopsis, 173, 1883.

*Notropis venustus*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1886, 19; but the true *venustus* seems to have still larger scales.

### 442. NOTROPIS STIGMATURUS (Jordan).

(Spotted-tail Minnow.)

Head 4½; depth 4¾; eye small, 4¼ in head. D. 8; A. 8; scales 7–42 to 44–3; teeth 1, 4–4, 1. Body elongate, fusiform, compressed. Head quite long, rounded above, the snout pointed. Mouth rather large, somewhat oblique, overlapped by the narrow upper jaw. Iris white. Maxillary reaching beyond nostrils; premaxillary on level of lower edge of pupil. Scales closely imbricated, 20 in front of dorsal. Fins low, the dorsal rather behind ventrals, its height less than one-fifth body. Color pale, clear olive; black dorsal spot not very distinct; fins with their tips charged with satin-white pigment, otherwise plain; a very distinct, large, oblong jet-black spot at base of caudal, the color extending up on the rays; this spot is visible on all specimens, and is larger than in any other of our *Cyprinidæ*; its length about one-third that of the head. First ray of dorsal dark in front; males with an obsolete black spot on the middle of the sides in front of the dorsal; the head, etc., tuberculate in spring. Length 4½ inches. Alabama Basin; very abundant. Very close to *N. cercostigma*, from which it differs chiefly in the smaller scales, and of which it may be an eastern variety. (*στίγμα*, spot; *οὐρά*, tail.)

*Photogenis stigmaturus*, Jordan, Ann. Lyc. Nat. Hist. N. Y., 1876, 337, Etowah River, etc., Rome, Georgia. (Type, No. 17891. Coll. Jordan & Gilbert.)

*Codoma stigmatura*, Jordan, Bull. U. S. Nat. Mus., xii, 52, 1878.

*Cyprinella calliura*, Jordan, Bull. U. S. Nat. Mus., x, 61, 1877, Black Warrior River, Alabama. (Type, No. 6865. Coll. Prof. Alex. Winchell.)

*Cliola calliura* and *stigmatura*, Jordan & Gilbert, Synopsis, 178 and 182, 1883.

### 443. NOTROPIS TRICHROISTIUS (Jordan & Gilbert).

Head 4⅛; depth 4¼; eye moderate, 3⅔ in head; scales 6–42–3; teeth 1, 4–4, 1. Body rather slender, compressed. Head slender and pointed.

Mouth quite large, very oblique, the maxillary reaching anterior margin of eye, the premaxillaries on level of middle of pupil. Lateral line considerably decurved, usually with an abrupt angulation between pectorals and ventrals; 19 scales before dorsal. Fins moderate; dorsal well behind ventrals. Nuptial tubercles sparse on the head; caudal peduncle and sides, as far forward as the ventrals, tuberculate in spring males. Males bright steel-blue above; sides bright white; a large black spot at base of caudal, precisely as in *N. callistius*; dorsal fin with a broad, dusky, horizontal band at base, the membrane of the last rays jet-black, the tip milk-white, the rest of the fin of a bright, pale vermilion-red; caudal rosy, its tips white; anal and ventrals milky. Females duller, but the black markings distinct. Length 3½ inches. Alabama Basin; abundant in clear streams, with the preceding and the next. (*τρεῖς*, three; *χρῶς*, color; *ἱστίον*, sail.)

*Codoma trichroistia*, Jordan & Gilbert, Bull. U. S. Nat. Mus., xii, 1878, 50, Etowah River, etc., Rome, Georgia. (Type, No. 31131. Coll. Jordan & Gilbert.)
*Cliola trichroistia*, Jordan & Gilbert, Synopsis, 181, 1883.

### 444. NOTROPIS CALLISTIUS (Jordan).

Head $4\frac{1}{5}$; depth $4\frac{3}{5}$; eye large, $3\frac{3}{5}$. D. 8; A. 8; scales 5–40–3; teeth 1, 4–4, 1. Body rather stout and compressed, rather heavy forward, the dorsal outline considerably elevated. Head stout and rather blunt, its upper part flattish; the nuptial tubercles not numerous, arranged in a few distinct, longitudinal rows, not scattered without order, as in related species. Mouth large, nearly horizontal, slightly overlapped by the heavy snout, the maxillary reaching nearly to eye, the premaxillaries anteriorly entirely below level of orbit. Scales large, not very closely imbricated, 16 in front of dorsal. Fins rather large, the height of the dorsal in males nearly one-fifth length of body. Coloration dark and brilliant; males with the back very dark steel-blue; sides a clear silvery violet; belly and lower fins satin-white; a heavy black blotch on posterior part of dorsal, extending downward and forming a horizontal bar at base of fin; rest of the fin vermilion, except the milk-white tip; caudal fin bright red, yellowish at base, milky at tip; a broad, golden vertebral band and a reddish lateral streak; a large, distinct, round black spot at base of caudal. Females olivaceous, with less black; the fins dull reddish. Length 4 inches. Alabama Basin. (*κάλλος*, beauty; *ἱστίον*, sail, i. e. dorsal fin.)

*Photogenis callistius*, Jordan, Ann. Lyc. Nat. Hist. N. Y., 1876, 337, Etowah River, etc., Rome, Georgia. (Type, No. 17882. Coll. Jordan & Gilbert.)
*Codoma callistia*, Jordan, Bull. U. S. Nat. Mus., xii, 52, 1878.
*Cliola callistia*, Jordan & Gilbert, Synopsis, 181, 1883.

### 445. NOTROPIS EURYSTOMUS (Jordan).

Head $4\frac{1}{4}$; depth $4\frac{1}{3}$; eye moderate, $3\frac{1}{2}$ in head. D. 8; A. 8; scales 6–39–3; teeth 1, 4–4, 1, with narrow grinding surfaces, the edges of which are usually crenate. Body elongate, compressed, tapering toward the snout and the long caudal peduncle. Head moderate, larger than in *N. niveus*, rather pointed, wide on top; snout rather long. Muzzle large, quite oblique, the premaxillaries on the level of the pupil; upper jaw slightly the longer. Scales moderate, rather closely imbricated, but less so than in *N. whipplii.* Pectorals not reaching ventrals, the latter about to vent; vertical fins not especially elevated. Color olivaceous, the sides bright silvery, a round black spot, nearly as large as eye, at base of caudal; dorsal blotch rather faint; dorsal fin chiefly yellowish green, ferruginous above, the extreme tip milky white; caudal fin rusty, with milk-white tips; lower fins milk-white. Snout and front in males tuberculate; minute tubercles on sides of tail. Length 4 inches. Chattahoochee River. (*εὑρύς*, wide; *στόμα*, mouth.)

*Photogenis eurystomus*, JORDAN, Ann. Lyc. Nat. Hist. N. Y., 1876, 356, Nancy's Creek, tributary of Chattahoochee River, near Atlanta; exclusive of the smaller specimens mentioned, which are *Notropis zonistius*; (not *Codoma eurystoma*, JORDAN, Bull. U. S. Nat. Mus. XII, 42 = *Notropis zonistius*).
*Photogenis leucopus*, JORDAN & BRAYTON, Bull. U. S. Nat. Mus., XII, 41, 1878, Chattahoochee River, Gainėsville, Georgia. (Type, No. 31124. Coll. Jordan & Brayton.)
*Cliola eurystoma*, JORDAN & GILBERT, Synopsis, 180, 1883.

### 446. NOTROPIS CÆRULEUS (Jordan).

Head 4⅓; depth 4⅗; eye moderate, 3½ in head. D. 8; A. 8; scales 6–38–3; teeth 1, 4–4, 1. Body fusiform, somewhat elongate, moderately compressed. Head moderate. Snout rather pointed, overlapping the small, oblique mouth, maxillaries reaching nostrils, premaxillaries below level of pupil. Scales firm, 15 in front of dorsal. Lateral line decurved. Fins all high, the height of dorsal nearly one-fifth length of fish; dorsal behind ventrals. Males with the snout thickly tuberculate. Color bright steel-blue; sides and belly silvery white; a very distinct lateral band of a bright blue-green color, most distinct posteriorly, and forming a spot at the base of caudal; black dorsal blotch rather faint and diffuse; tips of dorsal, anal, and caudal charged with satin-white pigment; the fins otherwise all of a clear, bright yellow. Females and young with the markings obscure, the blue lateral band usually evident. Length 3 inches. Alabama Basin; common; a very elegant little fish. (*cœruleus*, blue.)

*Photogenis cæruleus*, JORDAN, Ann. Lyc. Nat. Hist. N. Y., 1876, 338, Etowah River, Rome, Georgia. (Type, No. 17883. Coll. Jordan & Gilbert.)
*Codoma cærulea*, JORDAN, Bull. U. S. Nat. Mus., XII, 52, 1878.
*Cliola cærulea*, JORDAN & GILBERT, Synopsis, 182, 1883.

### 447. NOTROPIS NIVEUS (Cope).

Head 4½; depth 5½; eye 3⅓ in head. D. 8; A. 8; scales 6–39–3; teeth 1, 4–4, 1, with narrow grinding surface. Body regularly fusiform, the dorsal outline more arched than the ventral. Head conic. Muzzle obtuse, not projecting. Mouth nearly terminal, slightly oblique, maxillary reaching front of eye. Coloration very pale, a narrow bluish band along caudal peduncle, forming a faint spot at root of caudal. Dorsal fin in males considerably elevated, largely dusky on its last rays, the rest of the fin creamy; tip of dorsal, tips of caudal, and whole of anal with milk-white pigment. Males with the snout and antedorsal region covered with small tubercles. Length 2½ inches. Southern Virginia to South Carolina; common; an extremely variable species, which may prove to be inseparable as a species from *N. whipplii*, from which it differs in the slenderer head and in the blue caudal streak. (*niveus*, snowy.)

*Hybopsis niveus*, COPE, Proc. Amer. Phil. Soc. Phila., 1870, 460, Catawba River, North Carolina.
*Photogenis niveus*, JORDAN & BRAYTON, Bull. U. S. Nat. Mus., XII, 20, 1878.
*Cliola nivea*, JORDAN & GILBERT, Synopsis, 180, 1883.

Represented in the Santee Basin by

### 447a. NOTROPIS NIVEUS CHLORISTIUS (Jordan & Brayton).

Head 4; depth 4; eye small, less than snout, 4 in head. D. 7; A. 8; scales 5–36–3; teeth 1, 4–4, 1. Body short and deep, strongly compressed, the form elliptical, as in *N. pyrrhomelas*, but rather deeper. Head rather small and pointed. Mouth quite oblique, the maxillary not reaching line of orbit, the upper jaw projecting beyond lower; premaxillary on level of pupil. Lateral line decurved. Fins moderate. Nuptial tubercles covering the whole body, except space anterior to ventrals and below lateral line; those on the body much smaller than those on the head. Coloration dark steel-blue; a very distinct blue stripe along each side of caudal peduncle; back clear green; lower part of sides abruptly milk-white; black dorsal blotch large, the lower part of the fin with bright pale-green pigment, the tip milky; caudal dusky, its tips milky, its base pale; anal and ventrals milky, a faint dusky spot on last rays of anal; iris white. Females slenderer and less brightly colored; no caudal spot. Length 3 inches. Santee River and tributaries; common. This form occurs in the Catawba with the typical *niveus*, into which it seems to intergrade; both forms are very close to *N. whipplii*, but should probably be considered distinct species. (*χλωρός*, green; *ἱστίον*, sail.)

*Codoma chloristia*, JORDAN & BRAYTON, Bull. U.S. Nat. Mus., XII, 21, 1878, tributary of Saluda River, Greenville, South Carolina. (Type, No. not given. Coll. Jordan & Brayton.)
*Cliola chloristia*, JORDAN & GILBERT, Synopsis, 183, 1883.

### 448. NOTROPIS WHIPPLII (Girard).

(SILVER-FIN.)

Head 4¼; depth 4 in adult males; females and young more slender, 4¼ to 5; eye small, 4½ in head. D. 8; A. 8; scales 5–38 to 40–3; teeth 1, 4–4, 1, the edges more or less distinctly serrate. Body moderately elongate, somewhat compressed, the dorsal and ventral outlines regularly and gently arched. Head rather short and deep. Mouth rather small, quite oblique, the lower jaw received within the upper when the mouth is closed. Leaden silvery, bluish in the males; edges of scales dusky; a dark vertebral line; a large black spot on the upper posterior part of the dorsal. Paired fins and lower part of belly, as well as the tips of the anal and caudal, and the front and upper parts of dorsal, charged with clear, satin-white pigment in males in spring; in full breeding dress the dorsal pigment with a greenish luster; no creamy band at base of caudal; males with the head and front covered with small tubercles. Length 4 inches. Central New York, Cayuga Lake, to Minnesota, northern Alabama and Arkansas, in clear streams; very abundant in the Ohio Valley. (Named for Captain A. W. Whipple, who collected the types.)

*Cyprinella whipplii*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 198, Sugar Loaf Creek, tributary Poteau River, Arkansas. (Type, No. 137. Coll. Möllhausen.)

*Photogenis spilopterus*, Cope, Cypr. Penn., 378, 1866, St. Joseph River, Southwestern Michigan.

*Luxilus kentuckiensis*, Kirtland, Bost. Journ. Nat. Hist., v, 27, pl. viii, fig. 3, 1847, (not of Rafinesque).

*Hypsilepis kentuckiensis*, Cope, Cypr. Penn., 371, 1866.

*Leuciscus spilopterus*, Günther, Cat., vii, 254, 1868.

*Cliola whipplei* and *analostana*, Jordan & Gilbert, Synopsis, 178 and 179, 1883.

### 449. NOTROPIS ANALOSTANUS (Girard).

The eastern representative of *N. whipplii.* Entirely similar to *whipplii* except that the body is less elongate, the adult male 3½ in length instead of 4, and the scales larger, 34 or 35 in the lateral line instead of 38 to 40. Probably to be regarded as a different species, but possibly intergrading with *whipplii* on the westward and perhaps with *niveus* southward. Streams about Delaware and Chesapeake bays; abundant in the Potomac and James; recorded from the Susquehanna and Delaware. (From Analostan Island, in the Potomac.)

*Cyprinella analostana*, Girard, Proc. Ac. Nat. Sci. Phila., 1859, 59, Rock Creek, Analostan Island, Potomac River; Jordan & Gilbert, Synopsis, 179, 1883, (in part)

*Leuciscus analostanus*, Günther, Cat., vii, 256, 1868.

### 450. NOTROPIS GALACTURUS (Cope).

Head 4⅓; depth 4⅓. D. 8; A. 8; scales 6–41–3; teeth 1, 4–4, 1, usually with entire edges. Body fusiform, moderately elongate, not greatly compressed. Mouth rather large, jaws nearly horizontal, the upper projecting. Larger than *N. whipplii*, more elongate and less compressed, the scales less closely imbricated, the lateral line less decurved. Eye small. Steel-blue above, silvery below; dorsal with a black blotch on its posterior rays; caudal fin conspicuously creamy yellow at base, then dusky; males with the belly, paired fins, and especially tips of vertical fins charged with milk-white pigment in spring, the head and front then covered with small tubercles; in high coloration the anal and caudal are sometimes pale reddish; females olivaceous, obscurely marked. Length 5 to 6 inches. Ozark region to Cumberland, Tennessee, and Savannah rivers; abundant in the mountain streams. Known by its large size and the peculiar yellowish band across the caudal. (*γάλα*, milk; *οὐρά*, tail.)

*Hysilepis galacturus*, Cope, Proc. Ac. Nat. Sci. Phila., 1867, 160, Holston River, Virginia. (Type, No. 14981. Coll. Cope.)

*Leuciscus kentuckiensis*, Günther, Cat., vii, 251, 1868, not of Rafinesque.

*Cliola galactura*, Jordan & Gilbert, Synopsis, 179, 1883.

### 451. NOTROPIS CAMURUS (Jordan & Meek).

Head 4⅕; depth 3½. D. 8; A. 9; scales 6–38–4. More robust than *N. galacturus*, the back elevated; anterior profile steep, the snout bluntly decurved; mouth small, oblique; teeth crenate. Bluish silvery; dorsal fin in adult with a large dark blotch as in *N. whipplii*; males with silvery pigment. Length 4 inches. Arkansas River and tributaries, not rare in Kansas and southwestern Missouri. (*camurus*, blunt-faced.)

*Cliola camura*, Jordan & Meek, Proc. U. S. Nat. Mus., 1884, 474, Arkansas River, Fort Lyon, Colorado. (Type, No. 12256. Coll. Dr. E. Palmer.)

### 452. NOTROPIS XÆNURUS (Jordan.)

Head 4; depth 3¾; eye large, 3¾ in head. D. 8; A. 10; scales 6–39–3; teeth 1, 4–4, 1. Body moderately elongate, subfusiform, heavy forward. Head heavy, somewhat elongate, rounded above. Mouth large, oblique, the lower jaw included; maxillary reaching almost to orbit; premaxillary on level of upper part of pupil. Fins all rather low, the height of the dorsal fin, even in males, only two-thirds length of head; caudal fin large. Color dark steel-blue; silvery below; a faint black spot at base of caudal; scales above dark-edged; males with the fins mostly bright crimson; the dorsal largely black at its upper posterior part; dorsal, anal, and caudal fins with white pigment; belly and bases of lower fins likewise pigmented; head and caudal peduncle tuberculate in spring. Length 3 inches. Altamaha Basin, Georgia; locally abundant. (*ξαίνω*, to scratch; *οὐρά*, tail.)

*Minnilus xænurus*, Jordan, Proc. Ac. Nat. Sci. Phila., 1877, 79, Ocmulgee River, Flat Shoals, Georgia. (Type, No. 17862. Coll. Jordan & Gilbert.)
*Codoma xænura*, Jordan, Bull. U. S. Nat. Mus., XII, 52, 1878.
*Cliola xænura*, Jordan & Gilbert, Synopsis, 184, 1883.

### 453. NOTROPIS HYPSELOPTERUS (Günther).

Head 4¼; depth 4; eye 3. D. 8; A. 11; scales 6–35–3; teeth 1, 4–4, 1. Body short, much compressed, the back elevated. Head short, flattened above, the muzzle pointed. Mouth large, very oblique, the jaws just equal. Eye large, about equal to snout and to interorbital space. Scales with the exposed surfaces very narrow. Lateral line much decurved; 16 large scales before dorsal. Dorsal fin inserted entirely behind ventrals, greatly elevated, its longest ray a little longer than head; anal fin also very high and very long, extending almost to base of caudal; these fins somewhat lower in females. Color silvery; the dorsal blotch conspicuous; a distinct black caudal spot, smaller than eye and deeper than long; sides with a silvery band which passes around the nose, below this a dusky band. Breeding colors unknown. Length 2½ inches. Southern Georgia and Alabama. (*ὑψηλός*, high; *πτέρον*, fin.)

*Alburnus formosus*, Putnam, Bull. Mus. Comp. Zoöl., I, 9, 1863, Mobile, (not *Moniana formosa*, Girard).
*Leuciscus hypselopterus*, Günther, Cat., VII, 255, 1868, Mobile; substitute for *formosus*, preocupied. (Coll. Thos. Moore.)
*Photogenis grandipinnis*, Jordan, Bull. U. S. Nat. Mus., X, 62, 1877, Flint River, Georgia. (Type, No. 9296. Coll. Hugh M. Neisler.)
*Cliola hypseloptera*, Jordan & Gilbert, Synopsis, 184, 1883.

### 454. NOTROPIS PYRRHOMELAS (Cope).

Head 4; depth 3¾; eye large, 3. D. 8; A. 10; scales 6–35–3; teeth 1, 4–4, 1. Body deep and compressed. Head stout, rather blunt. Mouth oblique, the jaws about equal; maxillary reaching front of orbit. Pectorals barely reaching ventrals, the latter to anal; dorsal fin greatly elevated, its height in male as great as length of head; caudal very broad and long, its peduncle stout and compressed; anal fin large and long. Coloration of males dark steel-blue above; the scales darker-edged; belly abruptly milky white; head pale reddish; snout, tip of lower jaw, and iris scarlet; dorsal dusky at base, the usual large black blotch above, red in front, and broadly milk-white at tip; tips of caudal milk-white, next to this a dusky crescent, a wide crescent of bright scarlet inside of the black, extending into the two lobes of the fin; base of caudal pale; anterior region and sides of caudal peduncle with rather large tubercles. Females duller. Length 3¼ inches. Santee Basin; very abundant, the most ornate of our *Cyprinidæ*. (*πῦρ*, fire; *μέλας*, black.)

*Photogenis pyrrhomelas*, COPE, Proc. Amer. Phil. Soc. Phila., 1870, 463, Catawba River, North Carolina. (Coll. Cope.)

*Codoma pyrrhomelas*, JORDAN & BRAYTON, Bull. U. S. Nat. Mus., XII, 22, 1878.

*Cliola pyrrhomelas*, JORDAN & GILBERT, Synopsis, 184, 1883.

### 455. NOTROPIS GARMANI, Jordan.

Head 4½; depth 2⅔. D. 8; A. 11; scales 7–38–3; teeth 1, 4–4, 1. Body deep, much compressed, the back arched. Head small; snout shorter than eye; maxillary not reaching eye; pectorals not reaching ventrals, the latter to anal; caudal deeply forked; scales much deeper than long. Brownish above, sides rosy or silvery; cheeks silvery, a brownish band from nape to pectorals; lower fins salmon color; caudal reddish. Length 3 inches. Tributaries of Lago del Muerte, Coahuila. (Garman.) (Named for Samuel Garman, the accomplished ichthyologist of the Museum of Comparative Zoölogy.)

*Cyprinella rubripinna*, GARMAN, Bull. Mus. Comp. Zoöl., VIII, 91, 1881, Lago del Muerte.

*Notropis garmani*, JORDAN, Cat. Fish. N. Am., 813, 1885, (substitute for *rubripinna*).

*Cliola rubripinna*, JORDAN & GILBERT, Synopsis, 884, 1883. The name *rubripinnis* has been twice earlier used in *Notropis*.

## Subgenus LUXILUS, Rafinesque.

### 456. NOTROPIS CORNUTUS* (Mitchill).

(SHINER; RED-FIN; DACE.)

Head 4¼; depth 3¼, varying much with age; eye 4 to 5. D. 8; A. 9; scales 6–41–3; teeth 2, 4–4, 2, with rather narrow grinding surface. Body

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*We adopt the specific name *cornutus* for this species, as the first preliminary notice by Dr. Mitchill, in which the species is named *Cyprinus cornutus*, is sufficient for its identification. This was published in July or August, 1817. In December, 1817, the same species was described by Rafinesque as *Cyprinus megalops*, and in February, 1818, Dr. Mitchill gives a detailed account calling it *Cyprinus cornutus*. The following is the preliminary notice of the Fishes of the Wallkill River, Amer. Monthly Mag., I, 1817, 289, July:

TRANSACTIONS OF LEARNED SOCIETIES.—LYCEUM OF NATURAL HISTORY.

*Sitting of July 7, 1817.*—Dr. Benjamin Akerly presented several specimens of fish, which he had obtained in Wallkill Creek, and which appeared to be undescribed species.

*Sitting of July 14, 1817.*—Dr. Mitchill made a detailed report on the ichthyology of the Wallkill, from the specimens of fishes presented to the Society at the last meeting by Dr. B. Akerly in behalf of the committee of exploration. They consisted of several sorts of

CYPRINUS, OR CARP.

1. The Corporal, or *C. corporalis*, a splendid silvery fish inhabiting that stream, the sturgeon [?] of Albany and the western waters. (New.)
2. The Mudfish, or *C. atronasus*, so called from his having a black stripe from tail to head, and encompassing the nose. (New.)
3. The Red-fin, or *C. cornutus*, having elegant scarlet fins and knobs, or long protuberances over the head. (New.)

SILURUS, OR CATFISH.

1. The common Silure, or American *S. catus*; a steady inhabitant of our fresh rivers and ponds.
2. The frog Silure, or *S. gyrinus*; having but a single dorsal fin, and a lanceolate tail resembling that of a tadpole when full grown. (New.)

LABRUS.

1. The Sunfish, or *L. auritus*, with the scarlet fins to the gill covers.
2. The Brown Labre, or *Labrus appendix*; so called from the black appendages to the gill covers, broader and longer than the preceding species, and with various other marks of difference. (New.)

ESOX OR PIKE.

1. The white-bellied Shilli-fish [Killi-fish], or *Esox pisciculus*, of his memoir on the fishes of New York. The description by himself and the drawings by Dr. B. Akerly, are all completed.

elongate in the young, in the adult short, compressed, with the anterior dorsal region much swollen and gibbous. Head rather heavy, compressed, rounded between the eyes, the snout bluntish. Mouth moderate, nearly horizontal, the jaws nearly equal, the lower somewhat included. Eye moderate; maxillary scarcely reaching front of eye, the premaxillaries below the level of eye. Scales always deeper than long on the sides, becoming extremely deep in the adult. Lateral line decurved. Dorsal moderate, inserted directly over ventrals in young, thrown somewhat backward in adult by the growth of the nuchal region. Pectorals barely or not reaching ventrals, the latter about to vent. Region in front of dorsal typically with about 23 scales, the number ranging from 15 to 40. Coloration dark steel-blue above; the scales with dusky edges, the bases also dusky; a gilt line along the back and one along each side, these distinct only when the fish is in the water; belly and lower part of the sides silvery, bright rosy in spring males; dorsal fin somewhat dusky; other fins plain; the lower fins all rosy in spring males; head dark above; a dark shade behind scapula; lower jaw and region in front of dorsal to tip of snout covered with small tubercles in spring males; female and young fishes are plain olivaceous above and silvery below. Length 5 to 8 inches. Entire region east of the Rocky Mountains excepting the South Atlantic States and Texas; almost everywhere the most abundant fish in small streams. Its variations are great, some of them appearing like distinct species. (*cornutus*, horned.)

*Cyprinus cornutus*, Mitchill, Amer. Monthly Mag. Crit. Review, I, July, 1817, 289, Wallkill River, New York; preliminary notice; Mitchill, *l. c.*, II, February, 1818, 324, detailed description.

*Cyprinus megalops*, Rafinesque, Amer. Monthly Mag. and Crit. Review, I, December, 1817, 121, Hudson River, above the Falls.

*Cyprinus melanurus*, Rafinesque, *l. c.*, 121, Hudson River, above the Falls.

*Luxilus chrysocephalus*, Rafinesque, *l. c.*, 47, 1820, Ohio River.

?*Luxilus interruptus*,[*] Rafinesque, *l. c.*, 49, Ohio River; may be *N. rubrifrons.*

*Rutilus plargyrus*, Rafinesque, Ichth. Oh., 50, 1820, Ohio River.

? *Rutilus compressus*,[†] Rafinesque, *l. c.*, 51, Monongahela River, etc.; may be *N. photogenis.*

*Leuciscus vittatus*, De Kay, N. Y. Fauna: Fishes, 212, 1842, Chittenonda Creek, tributary of Mohawk River.

*Argyreus rubripinnis*, Heckel, Russeggers Reisen, 1843, 1040.

*Leuciscus spirlingulus*, Cuvier & Valenciennes, XVII, 321, 1844, New Jersey; New Harmony, Indiana. (Coll. Le Sueur.)

*Leuciscus obesus*, Storer, Proc. Bost. Soc. Nat. Hist., July, 1845, 48, Florence, Alabama. (Coll. C. A. Hentz.)

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[*] "42nd species, Yellow Shiner, *Luxilus interruptus*, Luxile jaunâtre: Diameter one-sixth of total length; yellowish olivaceous above, silvery beneath, rufous brown above the head, a rufous line from the dorsal to the tail, 2 straight and separated half lateral lines, the anterior one above the posterior; pectoral fins reaching the abdominal. Dorsal with 10 and anal with 9 rays. A small species, only 3 inches long, called Yellow Chub or Shiner. Seen in the Ohio. Sides opaque, with violet shades. Iris silvery, mouth large, lips very apparent. Fins yellowish, pectorals with 16 rays, caudals with 24."—*Rafinesque.*

[†] "47th species, Baiting Fallfish, *Rutilus compressus*, Rutile appat: Diameter one-seventh of total length; silvery, back fulvous, sides compressed, lateral line straight, raised upwards at the base, snout rounded, mouth hardly diagonal, nearly horizontal. Dorsal and anal fins with 9 rays. A small fish from 2 to 4 inches long, called Fallfish, Bait fish, Minny, etc. It is found in the Allegheny Mountains, in the waters of the Monongahela, Kanawha, and even in the Potomac. The name of Fallfish arises from its being often found near falls and ripples. Body more compressed than in the other species; as much so as in the genus *Minnilus*. Scales large; lips a little fleshy; iris silvery gilt; fins transparent; the pectoral with 14 rays, and not reaching the abdominal; tail with 32 rays."—*Rafinesque.*

*Plargyrus typicus*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 196, after Rafinesque.
*Plargyrus bowmani*, Girard, *l. c.*, 196, Sweetwater River, Nebraska. (Coll. Bowman.)
*Plargyrus argentatus*, Girard, *l. c.*, 212, James River, Virginia. (Coll. Baird.)
*Alburnops plumbeolus*, Cope, Proc. Ac. Nat. Sci. Phila., 1864, 282, Saginaw River, Flint, Michigan.
*Hypsilepis cornutus*, Cope, Proc. Ac. Nat. Sci. Phila., 1867, 158.
*Leuciscus cornutus*, Günther, Cat., vii, 249, 1868.
*Minnilus cornutus*, Jordan & Gilbert, Synopsis, 186, 1883.
*Minnilus plumbeolus*, Jordan & Gilbert, Synopsis, 192, 1883.

Represented northwards by the scarcely tangible

### 456a. NOTROPIS CORNUTUS FRONTALIS (Agassiz).

Thirteen to 18 scales before dorsal; head very heavy. Great Lakes; everywhere common in mouths of brooks. (*frontalis*. pertaining to the forehead.)

*Leuciscus frontalis* and *gracilis*, Agassiz, Lake Superior, 368, 370, 1850, Lake Superior.
*Hypsilepis cornutus gibbus*, Cope, Proc. Ac. Nat. Sci. Phila., 1867, 158, Monroe County, Michigan.

In Northern Michigan occurs

### 456b. NOTROPIS CORNUTUS CYANEUS (Cope).

Scales of the dorsal and ventral regions very small, 31 to 40 in front of dorsal fin. Scales 10–40–4. Coloration extremely dark; blue-black above; fins chiefly black. Northern Peninsula of Michigan; not known to us. (κυανέος, blue.)

*Hypsilepis cornutus cyaneus*, Cope, Proc. Ac. Nat. Sci. Phila., 1867. 160, Montreal River. Keweenaw, Michigan. (Coll. Dr. John H. Slack.)

In the Roanoke River are two strikingly different forms which should perhaps rank as distinct species.

### 457. NOTROPIS CERASINUS (Cope).

Fifteen scales before dorsal; scales 6–37–3. Eye 3½ in head; snout short and blunt; dorsal and anal high, their edges concave. Head 4 in length; depth 3⅗. Colors very brilliant. Steel-blue, the sides always marked with irregular blackish cross blotches and bars formed by a broad dark edging on some scales. Males flushed with pink, the fins all deep red. Length never more than 4 inches. Roanoke River, in mountain brooks. (*cerasinus*, cherry-red.)

*Hypsilepis cornutus cerasinus*, Cope, Proc. Ac. Nat. Sci. Phila., 1867, 159. Head waters of Roanoke River, Virginia. (Coll. Cope.)

### 458. NOTROPIS ALBEOLUS (Jordan).

Snout sharper than in the ordinary *cornutus*, the caudal peduncle and fin especially longer. Dorsal and anal high, their free edges concave. Eye 3½ in head; depth 4. Lateral line 38, 14 scales before dorsal. Pale, olivaceous above, sides and fins silvery white, the tip of the snout silvery in the male. Length 5 to 7 inches. Roanoke, Tar, and Neuse rivers, in the lower stretches and in the river channels, never in the mountain springs with *N. cerasinus*. Probably the representative form in the streams of the pine woods. The typical *cornutus* is not found coastwise south of the James. (*albeolus*, whitish.)

*Notropis megalops albeolus*, JORDAN, Bull. U. S. Fish Comm., VIII, 1888, (1891), 123, Roanoke River, near Roanoke, Virginia. (Coll. Jordan, Evermann, & Jenkins.)

### 459. NOTROPIS LACERTOSUS (Cope).

Head 4⅕; depth 4⅓; eye 3½. D. 8; A. 8; scales 5–38–3, 17 before dorsal. Teeth 2, 4–4, 2. Very close to *N. cornutus*, and resembling the young of the latter, but the mouth larger and the lower jaw projecting; maxillary 3 in head, reaching just past front of eye. Body stout, head broad and deep. Eye large, equal to muzzle and to width of interorbital space. Fins all low, dorsal inserted slightly behind ventrals. Green above, sides silvery; a dark speck on front of opercle; no red. Length 4 inches. Head waters of Tennessee River; rare. (*lacertosus*, lizard-like.)

*Hybopsis lacertosus*, COPE, Journ. Ac. Nat. Sci. Phila., 1868, 232, Bear Creek, tributary Middle Fork Holston River. (Coll. Cope.)
*Minnilus lacertosus*, JORDAN & GILBERT, Synopsis, 192, 1883.
*Notropis lacertosus*, JORDAN, Bull. U. S. Fish Comm., VIII, 1888, (1891), 144.

## Subgenus HYDROPHLOX, Jordan.

### 460. NOTROPIS MACDONALDI, Jordan & Jenkins.

Head 3¾; depth 4¾; eye 4⅛. D. 8; A. 9 or 10; scales 7–39–2; teeth 2, 4–4, 2, with narrow grinding surface. Allied to *Notropis zonatus*. Body elongate, compressed, the snout little convex; eye moderate, a little shorter than snout; mouth large, terminal, oblique, the lower jaw projecting, the maxillary to opposite front of eye, 2⅞ in head. Scales less crowded than in *N. cornutus*, 17 to 20 before dorsal; dorsal inserted behind ventrals; fins moderate. Greenish, with a diffuse band of plumbeous silvery; a dark streak along back; no caudal spot; fins plain; males with the snout, chin, and axils red. Length 5 inches. Mountain streams of Virginia, tributary to the James and Shenandoah; common. (Named for Marshall McDonald, U. S. Commissioner of Fish and Fisheries.)

*Notropis macdonaldi*, JORDAN & JENKINS, Proc. U. S. Nat. Mus., 1888, 354, pl. 44, fig. 4, Shenandoah River, Luray, Virginia. (Type, No. 39859. Coll. Jordan & Jenkins.)

### 461. NOTROPIS COCCOGENIS (Cope).

Head 4; depth 4¼; eye large, 3½. Scales 7–42–3; teeth 2, 4–4, 2. Body elongate, compressed, not at all elevated. Head rather pointed. Mouth large, very oblique, the premaxillary nearly on a level with pupil; lower jaw projecting beyond upper; maxillary reaching past front of eye. About 20 scales in front of dorsal. Back olivaceous; the scales dark-edged; belly and sides silvery, rosy in spring males; a dusky scapular band; a scarlet bar down the line of the preopercle; muzzle and upper lip red; a red axillary spot; outer half of dorsal black, lower half yellowish; outer part of caudal dusky, base paler; a faint lateral streak and a dark vertebral line; lower fins white; snout swollen and tuberculate in spring males; females silvery, with only traces of red markings. Length 5 inches. Cumberland, Tennessee, and Savannah rivers; abundant in the mountain streams, especially in the head waters of the Tennessee; a showy little fish. (*κόκκος*, berry red; *γένειον*, cheek.)

*Hypsilepis coccogenis*, COPE, Proc. Ac. Nat. Sci. Phila., 1867, 160, pl. 27, fig. 5, Holston River. (Type, No. 36849. Coll. Cope.)
*Leuciscus coccogenis*, GÜNTHER, Cat., VII, 253, 1868.
*Minnilus coccogenis*, JORDAN & GILBERT, Synopsis, 188, 1883.

### 462. NOTROPIS ZONATUS (Agassiz).

Head 4¼; depth 4⅔; eye very large, 3. D. 8; A. 9; scales 6–42–4; teeth 2, 4–4, 2, with narrow grinding surface. Body rather elongate, less slender than in *N. coccogenis*, the head long, not acute. Jaws equal; maxillary 3 in head, not reaching eye; snout shortish; lateral line decurved. Olivaceous, with a black lateral band, (plumbeous in female); no caudal spot and no spots on fins. Male in spring with the sides and lower parts flame-red. Length 5 inches. Mountain streams in the Ozark region of Missouri and Arkansas; abundant. A brilliant fish, representing *N. coccogenis* west of the Mississippi. (*zonatus*, banded.)

*Alburnus zonatus* (AGASSIZ) PUTNAM, Bull. Mus. Comp. Zoöl., 1, 9, 1863, Osage River, Mo.
*Notropis zonatus*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1886, 2.

### 463. NOTROPIS ZONISTIUS (Jordan).

Head 3⅘; depth 3⅔; eye 3½. D. 8; A. 10; scales 7–40–3; teeth 2, 4–4, 2, with very narrow grinding surface on 1 or 2 of them. Body rather stout, compressed, the back somewhat elevated, the form that of a young *Notropis cornutus*. Head heavy, broad and flattish above, the profile evenly descending. Mouth large, smaller than in *N. coccogenis*, oblique, the jaws about equal, the upper lip opposite middle of eye, the maxillary reaching front of orbit. Eye very large, longer than snout. Scales not very closely imbricated, 17 scales in front of dorsal. Lateral line strongly decurved. Fins moderate, pectorals scarcely reaching ventrals. Steel blue above; sides with considerable coppery luster; dorsal fin with a sharp jet black horizontal bar about half way up, reddish in young fishes, the tip of the fin somewhat milky, the base pale; a round black spot nearly as large as eye at base of caudal; anal fin plain; caudal dull ferrugineous red, pale at base as in *N. coccogenis*, milky at tip; back and sides with gilt lines; a faint red bar down the cheeks as in *N. coccogenis*; a dark humeral bar; males with the snout tuberculate; females plain, so much resembling *Notropis eurystomus*, from the same waters, that the two species were at first confounded. Length 4 inches. Chattahoochee River; the typical examples from Suwannee Creek. (*ζώνη*, zone; *ἱστίον*, sail.)

*Codoma eurystoma*, JORDAN & BRAYTON, Bull. U. S. Nat. Mus., XII, 42, 1878, (excl. syn., not *Photogenis eurystomus*, JORDAN).
*Luxilus zonistius*, JORDAN, Proc. U. S. Nat. Mus., 1879, 239, Suwannee Creek, tributary of Chattahoochee River, in Northern Georgia. (Type, No. 23452. Coll. Jordan & Brayton.)
*Minnilus zonistius*, JORDAN & GILBERT, Synopsis, 188, 1883.

### 464. NOTROPIS RUBRICROCEUS (Cope).

(Red Fallfish.)

Head 4; depth 4½; eye 3½. D. 8; A. 9; scales 7–38–3; teeth 2, 4–4, 2, the edges of the grinding surface often serrate. Body moderately elongate, somewhat compressed. Head comparatively long and rather pointed. Mouth rather large, oblique, the jaws about equal. Eye large, as long as snout, premaxillary rather below pupil; maxillary reaching beyond front of orbit. Lateral line somewhat decurved; 19 scales in front of dorsal. Dorsal inserted somewhat behind ventrals. Females olivaceous, sometimes flushed with red. Males dark steel blue, a dark lateral band of coaly punctulations, which is usually distinct on the anterior part of the body, and passes through the eye around the snout; fins all rich, clear red, the dorsal crimson, the caudal pink, the lower fins scarlet; head pale red, the lower jaw flushed as if bloody; eyes bluish or flushed with red; a lustrous streak along sides; silvery below. In high coloration the whole body is more or less red. Males with the head and antedorsal region dusted with fine white tubercles. Length 4 inches. Head waters of the Tennessee and Savannah rivers; a surpassingly beautiful little fish, abounding in rock pools at the foot of the cascades. (*ruber*, red; *croceus*, saffron color.)

*Hybopsis rubricroceus*, Cope, Journ. Ac. Nat. Sci. Phila., 1868, 231, pl. 28, fig. 4, Tumbling Creek, tributary North Fork Holston River. (Coll. Cope.)
*Hydrophlox rubricroceus*, Jordan & Brayton, Bull. U. S. Nat. Mus., xii, 32, 1878.
*Minnilus rubricroceus*, Jordan & Gilbert, Synopsis, 189, 1883.

### 465. NOTROPIS CHLOROCEPHALUS (Cope).

Head 4; depth 5; D. 8; A. 8; eye large, 3 in head; scales 6–39–3; teeth 2, 4–4, 2. Body stout, with deep caudal peduncle. Head broad, with descending muzzle; mouth oblique, the maxillary reaching beyond line of orbit; premaxillary opposite lower margin of pupil; interorbital space greater than muzzle. Lateral line moderately decurved; 16 scales in front of dorsal. Color olivaceous, everywhere dusted with blackish specks, forming a lateral band which terminates in a dusky spot at base of caudal; green vertebral and lateral lines; top of head and upper portion of cheeks metallic green; males with the belly dark crimson, the whole body more or less flushed; lower jaw not black; dorsal and caudal red at base; sides of head and lateral band red; snout and antedorsal region tuberculate; fins plain. Length 2½ inches. Santee Basin, in North and South Carolina; abundant in clear mountain streams. (*χλωρός*, green; *κεφαλή*, head.)

*Hybopsis chlorocephalus*, Cope, Proc. Amer. Phil. Soc. Phila., 1870, 461, Catawba River, North Carolina. (Coll. Cope.)
*Minnilus chlorocephalus*, Jordan & Gilbert, Synopsis, 190, 1883.

### 466. NOTROPIS LUTIPINNIS (Jordan & Brayton).

Head 4⅓; depth 4¼; eye 3⅔. D. 8; A. 8; scales 7–40–3; teeth 2, 4–4, 2. Body stout and rather strongly compressed, the dorsal region somewhat elevated, the outline of the back sloping each way from the dorsal fin.

Head short and rather deep, broad and flattish above, the muzzle moderately rounded. Eye rather large. Mouth rather large, but smaller than in the preceding, quite oblique, the maxillary reaching orbit; mandible included; 18 scales in front of dorsal. In life clear olive, with very intense green dorsal and vertebral lines; an intense metallic blackish band along sides; below this the sides are bright silvery; the whole body in the males bright, clear red; head and fins all bright golden yellow, with no red; tip of lower jaw black. Length 3 inches. Small clear streams of the pine woods, tributary to the Santee and Oconee rivers; rare. (*luteus*, yellow; *pinna*, fin.)

*Hydrophlox lutipinnis*, Jordan & Brayton, Bull. U. S. Nat. Mus., XII, 36, 1878, Oconee River, Hall's Springs, Georgia. (Type, No. 31090. Coll. Jordan & Brayton.)
*Minnilus lutipinnis*, Jordan & Gilbert, Synopsis, 190, 1883.
*Notropis lutipinnis*, Jordan, Bull. U. S. Fish Comm., VIII, 1888, (1891), 157.

### 467. NOTROPIS CHILITICUS (Cope).

Head 4; depth 5½; eye large, 3 in head, longer than muzzle. D. 8; A. 8; scales 7–36–2; teeth 2, 4–4, 2. Body elliptical. Head broad behind; occiput convex. Muzzle acuminate, greater than interorbital width. Maxillary extending beyond anterior rim of orbit; premaxillaries opposite middle of pupil; lateral line strongly decurved. Dorsal fin small. Olivaceous, a distinct silvery lateral band; usually a dark caudal spot; dorsal scales brown-edged; males with the lips and snout vermilion; a vermilion band through dorsal and one through anal fin. Length 2 inches. Allied to *N. altipinnis*, but more slender, with larger mouth. Basin of the Great Pedee River, North Carolina, common in upland streams. (χεῖλος, lip.)

*Hybopsis chiliticus*, Cope, Proc. Amer. Phil. Soc. Phila., 1870, 462, Yadkin River, Roane County, North Carolina. (Coll. Cope.)

### 468. NOTROPIS ALTIPINNIS (Cope).

Head 4⅓; depth 3½; eye very large, longer than snout, 2¾ in head. D. 8; A. 9; scales 5–36–2. Allied to *N. chalybæus*, but more robust in form. Body rather short and deep; head short, compressed. Ventrals extending to beyond last rays of dorsal, reaching anal. Dorsal elevated, its height equal to half its distance from the snout. Scales before dorsal small. Greenish; a lateral silvery band, strongly punctate with black; a black band across eye and snout; lower jaw always blackish; young with a black caudal spot; no black at base of anal; snout yellowish; vertical fins light reddish in life. Length 2½ inches. Clear streams of the pine woods, tributary to the Great Pedee and Cape Fear rivers; abundant. (*altus*, high; *pinna*, fin.)

*Alburnellus altipinnis*, Cope, Proc. Amer. Phil. Soc. Phila., 1870, 464, Yadkin River, Roane County, North Carolina. (Coll. Cope.)
*Minnilus altipinnis*, Jordan & Gilbert, Synopsis, 195, 1883.

### 469. NOTROPIS ROSEUS (Jordan).

Head 4⅓; depth 4½; eye nearly 3. A. 7, never 8, as in the related *N. chalybæus*. Scales 5–38–5; teeth 2, 4–4, 2. Body short and stout, little compressed. Head rather short, thick, bluntly rounded. Mouth moderate, slightly oblique, the jaws about equal. Eye large, about equal to muzzle, a little less than the broad interorbital space. 15 scales before dorsal; dorsal fin high, directly over ventrals. Olivaceous; scales dark-edged; a broad plumbeous lateral band; lips black; a dark caudal spot; a dark vertebral line; anal region dusted with dark points; cheeks and belly silvery; males with the dorsal, anal, caudal, and pectorals mostly rosy red; iris, top of head, and tip of snout red. Length 2½ inches. Lowland streams of the Gulf States from the Ogeechee to the Mississippi; the commonest species in the Okeefinokee swamps. (*roseus*, rosy.)

*Luxilus roseus*, JORDAN, Bull. U. S. Nat. Mus., x, 61, 1877, Notalbany River, near Tickfaw, Louisiana. (Type No. 17831. Coll. Bean.)
*Minnilus roseus*, JORDAN & GILBERT, Synopsis, 189, 1883.

### 470. NOTROPIS CHALYBÆUS (Cope).

Head 3⅘; depth 5; eye large, 3 in head. D. 8; A. 8; scales 6–33–3; teeth 2, 4–4, 2. Body moderately elongate, the back a little elevated, with slender caudal peduncle. Head flat above, rather narrow; muzzle rather pointed. Mouth very oblique, the lower jaw the longer. Lateral line decurved. Dorsal inserted behind ventrals; dorsal and anal very short and high; pectorals and ventrals short; 16 to 18 scales in front of dorsal. Color dark; a broad, black, shining lateral band from muzzle to base of caudal; a light band above it on the muzzle; belly straw-colored, bright orange in spring males; fins plain; a small dark spot at base of caudal; a dark streak along base of anal. Length 2 inches. Delaware River to the Ogeechee River; in coastwise streams and swamps, rather scarce. Strongly resembles *N. anogenus*, the teeth, and scales of back different. (χαλυβαῖος, iron-colored.)

*Hybopsis chalybæus*, COPE, Cypr. Penn., 383, 1866, Schuylkill River, Pennsylvania.
*Minnilus chalybæus*, JORDAN & GILBERT, Synopsis, 191, 1883.

### 471. NOTROPIS CHROSOMUS (Jordan).

Head 4⅓; depth 5; eye 3¼, as long as muzzle. D. 8; A. 8; scales 5–37–3; teeth 2, 4–4, 2. Form chubby, little compressed, the back somewhat elevated; caudal peduncle not much contracted. Head rather large, rounded above, the snout somewhat pointed. Mouth moderate, oblique, the upper jaw the longer. Scales everywhere large, 16 before dorsal. Lateral line little decurved. Scales hyaline green in life, with blue reflections; belly clear silvery; a scarlet bar across dorsal, anal, and base of caudal; a narrow scarlet band from upper edge of opercles straight to caudal; below this a silvery band; a row of black dots along lateral line, forming a small, distinct spot at base of caudal; top of head and vertebral line golden. Snout tuberculate in males. Length 2½ inches. Alabama Basin; very abundant in clear streams and outlets of springs. A graceful little fish. (*chrosomus*, colored body, name of a related genus.)

*Hybopsis chrosomus*, JORDAN, Ann. Lyc. Nat. Hist. N. Y., 1876, 333, Etowah River, etc., Rome, Georgia. (Type, No. 17881. Coll. Jordan & Gilbert.)
*Hydrophlox chrosomus*, JORDAN & BRAYTON, *l. c.*, 49, 1878.
*Minnilus chrosomus*, JORDAN & GILBERT, Synopsis, 191, 1883.

### 472. NOTROPIS XÆNOCEPHALUS (Jordan).

Head 4⅕; depth 5; eye very large, 2¾ in head. D. 8; A. 7; scales 5–38–3; teeth 2, 4–4, 2. Body rather short and deep, with thick caudal peduncle; back wide, not elevated. Head large, flattish and broad above, the snout rounded; mouth large, oblique, the jaws nearly equal. Lateral line somewhat decurved; 13 scales in front of dorsal; dorsal slightly behind ventrals. Dark olivaceous above, the scales being extensively dark-edged, so as to give a checkered appearance; a dark band along sides of caudal peduncle, which vanishes in black points along sides of body, reappearing on the head and passing around the snout; a dusky blotch at base of caudal; males without red markings, the snout swollen and tuberculate in the spring. Length 2¾ inches. Georgia to Mississippi; common in streams of the pine woods, descending to brackish water; abundant in Perdido Bay. (*ξαίνω*, to scratch; *κεφαλή*, head, from the tuberculate male.)

*Hybopsis xænocephalus*, JORDAN, Ann. Lyc. Nat. Hist. N. Y., 1876, 334, Etowah River, etc., Rome, Georgia. (Type, No. 20116. Coll. Jordan & Gilbert.)
*Minnilus xænocephalus*, JORDAN & GILBERT, Synopsis, 192, 1883.

### Subgenus ORCELLA, Jordan & Evermann.

### 473. NOTROPIS ORCA, Woolman.

Head 4½; depth 5; eye 4, small, slightly shorter than snout. D. 7; A. 8; scales 8–42–4. Teeth, 2, 4–4, 2, strongly hooked, with little or no grinding surface. Body plump, little compressed, with broad back and belly; dorsal outline somewhat elevated; head heavy, snout blunt, decurved; mouth subinferior, little oblique, lower jaw slightly included; maxillary scarcely reaching vertical of pupil. No barbel. Top of head unusually high and transversely rounded so that the eye is as near the lower as to the upper profile of head; interorbital space very wide and very convex, equal to distance from tip of snout to pupil. Fins moderate, origin of dorsal a little nearer snout than base of caudal, slightly behind insertion of ventrals; dorsal falcate, its first rays longest, 1⅓ in length of head; its last rays less than half length of first; anal not so high, its longest rays 1½ in head, and about twice as long as its last ray; margin concave; pectorals slightly falcate, about reaching ventrals, 1½ in head; ventrals short, 2 in head, not reaching vent; caudal very deeply forked, the middle rays 2½ in longest lateral ones, which are as long as head. Scales rather large, thin, lateral line somewhat decurved. Color in spirits pale; side with a broad, distinct silvery band, as broad as length of snout, bordered above by a narrow plumbeous line; back sparsely covered with fine dark punctulations, median line of back with a faint plumbeous band; top of head darkish, rest of head silvery; under part pale; fins pale. Length 3½ inches. Rio Grande at El Paso, Texas; several specimens. A curious species, little related to any other. (*orca*, the great killer, from a slight resemblance in form of head to that of a dolphin.)

*Notropis orca*, WOOLMAN, Bull. U. S. Fish Comm., XIV, 1894, (May 3, 1894), 56, Rio Grande, El Paso, Texas. (Coll. Woolman & Cox.)

## Subgenus NOTROPIS.

### 474. NOTROPIS ARIOMMUS (Cope).

Head 3¾ to 4¼; depth 4¼ to 5. D. 8; A. 9; scales 6–39–2; teeth 2, 4–4, 2. Body stout, moderately elevated, somewhat compressed. Head heavy, broad above, the snout moderate, somewhat decurved. Mouth moderate, oblique, the jaws equal, the upper lip on level of pupil, the maxillary reaching the front of eye. Eye very large, 2⅗ in head, much longer than snout, larger than in any other of the American Cyprinidæ, except *N. swaini*. Fins moderate, the dorsal almost directly opposite ventrals. Scales large, 15 in front of dorsal. Lateral line much decurved. Olivaceous; scales above dark-edged; sides and below bright silvery; no red. Length 5 inches. Ohio and Tennessee valleys, generally rare, but abundant about Indianapolis; Greensburg, Kentucky; and Florence, Alabama. A handsome species. (*ἀρι-*, an intensive particle; *ὄμμα*, eye.)

*Photogenis ariommus*, COPE, Cypr. Penn., 378, 1866, White River, near Indianapolis.
*Minnilus ariommus*, JORDAN & GILBERT, Synopsis, 194, 1883.

### 475. NOTROPIS SCABRICEPS (Cope).

Head 4; depth 4¼; eye very large, 3 in head, longer than snout. D. 8; A. 8; scales 6-38–3; teeth 2, 4-4, 2. Body rather stout, little compressed, the back slightly elevated, the form as in *Hybopsis amblops*. Head rather short and broad, the muzzle bluntish, somewhat decurved. Mouth moderate, terminal, little oblique, the jaws subequal, the maxillary reaching front of orbit. Lateral line not much decurved. Fins rather small; dorsal inserted over ventrals. Color plain olivaceous; scales dark-edged above; sides white, with a lateral band formed of dusky specks, this band running through the eye around the snout. Males tuberculate in spring. Smaller than *N. ariommus* and less silvery. Kanawha River, scarce; not yet recognized elsewhere. (*scaber*, rough; *–ceps*, head.)

*Photogenis scabriceps*, COPE, Proc. Ac. Nat. Sci. Phila., 1867, 166, Sinking Creek, Walker's Creek, tributaries of Kanawha River. (Coll. Cope.)
*Minnilus scabriceps*, part, JORDAN & GILBERT, Synopsis, 194, 1883; confused with *N. shumardi*.

### 476. NOTROPIS JEJUNUS (Forbes).

Head 4; depth 4⅔; eye rather large, 3⅔ in head, equal to snout, less than interorbital space. D. 8; A. 7; scales 5–37–3; teeth 2, 4–4, 1. Body rather slender; head flattish above, the snout blunt and rounded; mouth rather large, oblique. Dorsal over ventrals; 16 scales before dorsal. Color pale, with a broad silvery lateral band overlying a plumbeous shade; dorsal sometimes punctulate. Length 3 inches. Western Pennsylvania to Kansas, and north to Winnipeg; not rare. (*jejunus*, hungry.)

*Episema jejuna*, FORBES, Bull. Ills. Lab. Nat. Hist., II, 60, 1878, Illinois River. (Coll. Forbes.)
*Minnilus jejunus*, JORDAN & GILBERT, Synopsis, 194, 1883.

### 477. NOTROPIS SWAINI, Jordan.

Head 4⅙; depth 4½; eye very large, 2⅔ in head, half longer than the bluntish snout. D. 9; A. 8 or 9; scales 6–35 to 38–3, 14 before dorsal; teeth 1, 4–4, 2, or 1, with very narrow grinding surface or none. Body moderately elongate, compressed, rather stouter than in *N. rubrifrons*. Head short and broad, the interorbital space ⅔ eye. Mouth large, oblique, the lower jaw projecting; maxillary to near front of pupil, 2⅘ in head; dorsal inserted behind ventrals; fins small. Color greenish, with a plumbeous lateral shade and dark dots; no spot at base of caudal; fins pale. Length 2½ inches. Rivers of Texas from the Colorado westward, the type from Rio Comal. (Named for Dr. Joseph Swain, President of the University of Indiana.)

*Alburnus megalops*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 193, San Felipe Creek, Texas.
*Notropis swaini*, JORDAN, Proc. U. S. Nat. Mus. 1885, 123, Rio Comal; EVERMANN and KENDALL, Bull. U. S. Fish Comm., XII, 1892, (1894), 103, plate XVII, fig. 3.
*Alburnellus megalops*, GIRARD, U. S. Mex. Bound. Surv., Ichth., 52, 1859. (Coll. Clark.)
*Minnilus megalops*, JORDAN & GILBERT, Synopsis, 195, 1883, not *Cyprinus megalops*, RAFINESQUE.

### 478. NOTROPIS AMABILIS (Girard).

Head 3⅘; depth 4⅓; eye large, considerably longer than snout, 3 in head. D. 8; A. 8; scales 5–34–3. Body elliptical, rather deep, head short and rather deep, less acute than in *N. dilectus*. Mouth terminal, oblique, the maxillary reaching front of eye. Jaws equal, snout moderately pointed. Lateral line decurved. Fins moderate. Dorsal somewhat behind ventrals. Color olivaceous; sides silvery; a faint dusky blotch at base of caudal. Length 2½ inches. Rio Leona, a tributary of Rio Nueces, Texas. (*amabilis*, amiable.)

*Alburnus amabilis*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 193, Rio Leona, Texas.
*Notropis amabilis*, JORDAN, Proc. U. S. Nat. Mus. 1885, 122.
*Alburnellus amabilis*, GIRARD, U. S. Mex. Bound. Surv., Ichth., 51, 1859. (Coll. Clark.)
*Minnilus amabilis*, JORDAN & GILBERT, Synopsis, 195, 1883.

### 479. NOTROPIS LEUCIODUS (Cope).

Head 4½; depth 5. D. 8; A. 8; scales 5–39–3. Body rather slender; muzzle rounded in profile. Mouth oblique, the mandible not projecting. Lateral line nearly straight; 13 scales in front of dorsal; dorsal a little behind ventrals; anal short and high. Olivaceous; scales above dark-edged; sides silvery, with a purplish band; a black spot at base of caudal, always very distinct; muzzle and base of dorsal red in males. Length 3 inches. Tennessee Basin, in mountain streams very abundant, but not ascending cold brooks as far as *N. telescopus*, *spectrunculus*, and *rubricroceus*. It is close to *N. telescopus*, but has the anal shorter, the eye smaller, paler colors, and always a distinct caudal spot. (*λευκός*, white; *εἶδος*, appearance.)

*Photogenis leuciodus*, COPE, Proc. Ac. Nat. Sci. Phila., 1867, 165, Holston River, Virginia.
*Minnilus leuciodus*, JORDAN & GILBERT, Synopsis, 194, 1883. (Coll. Cope.)

### 480. NOTROPIS SCOPIFER, Eigenmann & Eigenmann.

Head 4 to 4½; depth 4½; eye 3 in head, little less than interorbital. D. 9; A. 8 or 9; scales 6–36 to 42–4; 14 to 18 scales in front of dorsal; teeth 2, 4–4, 2, grinding surface very narrow, on two teeth only. Allied to *Notropis leuciodus*. Head heavy, compressed, flat above; snout blunt, much decurved; mouth small, little oblique; maxillary extending to eye; lateral line complete, evenly and gently decurved to above origin of anal; a conspicuous black spot at base of middle caudal rays; a silvery lateral band, its dorsal margin distinct. Manitoba; common; obtained at Winnipeg, Brandon, Fort Qu 'Appelle and Medicine Hat. (Eigenmann & Eigenmann.) (*scopa*, broom; *fero*, I bear.)

*Notropis scopiferus*, EIGENMANN & EIGENMANN, Amer. Nat., February, 1893, 153, Winnipeg.

### 481. NOTROPIS TELESCOPUS (Cope).

Head 4¼; depth 4¾ to 5½; eye very large, longer than muzzle, 2¾ in head. D. 8; A. 10; scales 5–38–3. Body elongate, not much compressed; snout short, sharp; 13 scales before dorsal; dorsal fin inserted about midway between snout and base of caudal, a little behind ventrals. Mouth very oblique; mandible not projecting. Color pale greenish; the dorsal scales extensively dark-edged, the two uppermost rows of scales running into outline of back. Length 4 inches. Tennessee River; in cold mountain streams, very abundant; with *N. leuciodus*, making the bulk of the small minnows in the Holston River. (*τηλέσκοπος*, far-seeing.)

*Photogenis telescopus*, COPE, Proc. Ac. Nat. Sci. Phila., 1867, 165, Holston River, Virginia. (Coll. Cope.)
*Leuciscus telescopus*, GÜNTHER, Cat., VII, 252, 1868.
*Minnilus telescopus*, JORDAN & GILBERT, Synopsis, 201, 1883.

Represented in the Ozark region by

### 481a. NOTROPIS TELESCOPUS ARCANSANUS, Meek.

Head 4⅖; depth 5 to 5⅓; scales 5–35 to 38–3, 15 before dorsal. A. 10 or 11. Eye 2¾ in head, the pointed snout 3⅔. Smaller than the eastern form and darker, the dorsal farther back, midway between nostril and base of caudal; slightly behind ventrals. White River and Little Red River, Arkansas.

*Notropis telescopus arcansanus*, MEEK, Bull. U. S. Fish Comm., IX, 1889, (1891), 133, White River, Eureka Springs, Arkansas; Mammoth Springs, Arkansas. (Coll. Meek & Drew.)

### 482. NOTROPIS SOCIUS (Girard).

Head 4; depth 4⅓; eye 3. D. 8; A. 10. Lateral line 33. Allied to *Notropis swaini*, but deeper; the eye smaller, maxillary past front of eye; lower jaw longest. Silvery, the sides without dark dots; fins plain. Live Oak Creek, southwestern Texas. (*socius*, social.)

*Alburnus socius*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 193, Live Oak Creek, Texas. (Type, No. 70. Coll. Pope.)

### 483. NOTROPIS NOTEMIGONOIDES, Evermann.

Head 4 to 4¼; depth 4 to 4¼. D. 8; A. 10 or 11; scales 10–41–3, 29 before dorsal; teeth 2, 4–4, 2, hooked, crenate, with moderate grinding surface. Body slender, greatly compressed, the back somewhat elevated, the form much as in *Abramis* (*Notemigonus*) *crysoleucas*; snout pointed, equal to eye, which is 3¼ to 3½ in head; caudal peduncle long. Fins moderate; dorsal well behind ventrals; anal long; pectorals falcate, not reaching ventrals. Yellowish, silvery below; upper parts dusted with black; spots on anterior part of sides so arranged as to form about 16 obtuse angles fitting into each other, the angles opening forward, thus, ≫, these markings on alternate scales; tip of lower jaw with dark specks; fins pale, dusted with dark specks. Rio Neches, near Palestine, Texas, and streams about Houston. (*Notemigonus; εἶδος*, likeness.)

*Notropis notemigonoides*, EVERMANN, Bull. U. S. Fish Comm., XI, 1891, (May 25, 1892), 81, Neches River, Palestine, Texas, and Sims Bayou, Houston, Texas. (Type, No. 45559. Coll. Evermann, Scovell, & Gurley); Evermann & Kendall, Bull. U. S. Fish Comm., XII, 1892 (1894), 103, pl. XVIII, fig. 2.

### 484. NOTROPIS STILBIUS, Jordan.

Head 4⅕; depth 5; eye 3. D. 8; A. 10; scales 5–37–2; teeth 2, 4–4, 1. Body rather slender. Head rather long, somewhat pointed. Mouth large, oblique, the maxillary reaching eye. Eye very large, greater than snout and interorbital width. Fins rather high; the ventrals reaching to opposite last rays of dorsal. Color pale green; side with a broad silvery band, on which are many dark punctulations; these are numerous just behind shoulder girdle and at base of caudal, where they form an evident spot, a mark which will usually distinguish this species from the related ones; cheeks pure silvery; lips dusky. Length 3 inches. Alabama River and tributaries; common. (*στίλβη*, shining.)

*Notropis stilbius*, JORDAN, Ann. Lyc. Nat. Hist. N. Y., 1876, 343, Etowah and Oostanaula rivers, Rome, Georgia. (Type, No. 31132. Coll. Jordan & Gilbert.)
*Minnilus stilbius*, JORDAN & GILBERT, Synopsis, 201, 1883.

### 485. NOTROPIS ATHERINOIDES, Rafinesque.

Head 4⅔; depth 5½; eye 3¼. D. 8; A. 11; scales 5–38–3, 15 before dorsal; teeth 2, 4–4, 2. Body long and slender, compressed, the back not elevated, Head blunt, conic, proportionately shorter than in related species. Mouth moderate, very oblique, upper lip on level of upper part of pupil; maxillary about reaching front of eye. Eye large, rather longer than snout. Fins low; dorsal well behind ventrals; tips of ventrals extending to beyond middle of dorsal. Lateral line decurved. Color translucent green above; sides bright silvery; scales above faintly punctate, but not enough so to render them dark-edged, nor to form blotches along sides; a faint dark vertebral line; males in spring with the snout rosy. Length 4 to 6 inches. Great Lake region and Ohio and Mississippi valleys, and north to Winnipeg. Abundant in lakes, quiet places, and river channels; very variable. Next to *N. arge*, the largest and handsomest species of this type. (*atherina*, the silverside; *εἶδος*, resemblance.)

*Notropis atherinoides*, RAFINESQUE, Amer. Month. Mag. & Crit. Rev., 1818, 204, Lake Erie.
*Minnilus dinemus*, RAFINESQUE, Ichth. Oh., 45, 1820, Ohio River.
*Alburnus rubellus*, AGASSIZ, Lake Superior, 364, 1850, Lake Superior.
*Alburnus nitidus*, KIRTLAND, Cleveland Ann. Sci., 1854, 44, tributaries of Lake Erie.
*Alburnellus jaculus*, COPE, Cypr. Penn., 387, 1866, St. Joseph River and Dowagiac River, Michigan.
*Leuciscus rubellus*, GÜNTHER, Cat., VII, 254, 1868.
*Leuciscus copii*, GÜNTHER, *l. c.*, 255, substitute for *jaculus*, preoccupied in *Leuciscus*.
*Minnilus rubellus* and *dinemus*, JORDAN & GILBERT, Synopsis, 202, 1883.

### 486. NOTROPIS ARGE (Cope).

Head 4¼; depth 6: eye 2¾ to 3. D. 8; A. 11; scales 5–39–3. Close to *N. atherinoides* but the eye very large, longer than snout; lateral line nearly straight, head large, the snout not very blunt; mouth large, the chin projecting. Pale greenish, the silvery band on sides bounded by a blackish line; a dark vertebral streak. Length 3½ inches. Upper Wabash Valley, southern Michigan, Green River, Kentucky, etc.; slenderer than the usual *atherinoides*, the eye much larger, but apparently varying into the latter, hence of doubtful validity. (*ἀργή*, shining white.)

*Alburnellus arge*, COPE, Cypr. Penn., 388, 1866, Detroit River or St. Joseph River; locality confused.

*Notropis arge*, EVERMANN & JENKINS, Proc. U. S. Nat. Mus., 1888, 47; JORDAN, Man. Vert., ed. v, 62, 1890.

### 487. NOTROPIS DILECTUS (Girard).

Head 4⅔; depth 4¾; eye 3. D. 8; A. 11; scales 7–38–3; teeth 2, 4–4, 2. Body elongate, compressed, but a little deeper and more compressed, with blunter snout; eye large, larger than snout; mouth oblique, smaller than in related species, the jaws subequal, the maxillary 3⅓ in head, reaching eye. Colors very pale; silvery, snout and bases of fins rosy; a row of black dots above base of anal; young often finely speckled. Length 3½ inches. Lower Ohio to the Rio Grande, abundant in Arkansas and eastern Texas, in sandy streams; representing *rubrifrons* southwestward, and perhaps varying into it. (*dilectus*, delightful.)

*Alburnus dilectus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 193, Arkansas River, Fort Smith. (Type, No. 71 (36927). Coll. Shumard.)

*Alburnus lepidulus*,* GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 212, Black Warrior River, Alabama. (Coll. Winchell.)

*Alburnus oligaspis*, COPE, Proc. Ac. Nat. Sci. Phila., 1864, 282, Kansas; anal rays given by error as I, 14. (Coll. Dr. W. A. Hammond.)

*Alburnellus jemezanus*, COPE; Zoöl. Wheeler Survey, v, 650, 1875, Rio Grande, San Ildefonso, New Mexico. (Type, No. 15981. Coll. Cope & Yarrow.)

*Alburnellus dilectus*, GIRARD, Pac. R. R. Surv., x, 259, 1858.

*Albramis ? oligaspis*, GÜNTHER, Cat., VII, 309, 1868.

*Minnilus oligaspis*, JORDAN & GILBERT, Synopsis, 200, 1883.

*Minnilus jemezanus*, JORDAN & GILBERT, Synopsis, 203, 1883.

### 488. NOTROPIS FUMEUS, Evermann.

Head 4⅔; depth 4⅕ to 5; eye large, 3⅓. D. 8; A. 11; scales 7–40–3; teeth 2, 4–4, 2. Close to *Notropis dilectus*, but the lateral line more decurved, the scales a little smaller, and the sides with a dark band. Body slender, greatly compressed, the outlines gently arched; snout pointed, shorter than eye; lower jaw somewhat projecting; maxillary scarcely reaching orbit. Yellowish above, much speckled, sides with a broad dark plumbeous band, overlaid with rather large brown spots, most numerous and distinct posteriorly; base of anal with row of specks; fins plain, with dusky specks. Length 2 inches. Hunter Creek, Houston, Texas. Perhaps a variety of *N. dilectus*. (*fumeus*, smoky.)

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* This nominal species is probably identical with *N. dilectus*. The following description is taken from 3 specimens 2¾ inches long, collected in Pearl River, Jackson, Miss., by Dr. O. P. Hay:

Body long and slender. Maxillary scarcely reaching front of orbit. Front of dorsal equidistant between snout and concavity of caudal. Eye 3 in head, equal to interorbital space. Mandible projecting slightly, its tip, when closed, opposite middle of pupil. Lateral line decurved; 17 scales in front of dorsal. Dorsal fin high, its highest rays equal to head. Color pale, the sides bright silvery; a row of dots along base of anal. Head 4½; depth 5 or 6. D. 11; A. 12. Scales 7–35–3. Sandy streams of Alabama and Mississippi.

*Notropis fumeus*, Evermann, Bull. U. S. Fish Comm., xi, 1891, (May 25, 1892), 81, Hunter Creek, Houston, Texas. (Type, No. 45558. Coll. Evermann, Scovell, & Gurley); Evermann & & Kendall, Bull. U. S. Fish Comm., xii, 1892 (1894), 103, pl. xviii, fig. 1.

### 489, NOTROPIS RUBRIFRONS (Cope).

Head 4; depth 4¾; eye 4. D. 8; A. 10; scales 5–39–3, those before dorsal large, 15 to 17 in number. Teeth 2, 4–4, 2, little hooked, one of them sometimes showing a slight grinding surface. Body moderately elongate, the back scarcely elevated, the caudal peduncle somewhat contracted. Head longer than in most related species, conic and rather pointed. Mouth rather large, very oblique, upper lip above line of middle of pupil, maxillary reaching to opposite eye. Eye moderate, anterior, usually shorter than the sharp snout. Olivaceous above; scales with darker edges; sides silvery; a dark vertebral line; a row of dark dots along base of anal; males with the snout tuberculate in spring, the forehead, opercular region, and base of dorsal being then flushed with red. Length 2¾ inches. New York and western Pennsylvania to southern Michigan, Kansas, and Kentucky; very abundant in clear streams, especially in the Ohio Valley. An elegant species, smaller than *atherinoides*, with larger head and deeper body. It will probably be found to grade into *N. dilectus*, but in all specimens examined the eye is larger in *dilectus*, the snout shorter and more blunt. (*ruber*, red; *frons*, forehead.)

*Alburnus rubrifrons*, Cope, Proc. Ac. Nat. Sci. Phila., 1865, 85, Kiskiminitas River, a tributary of Alleghany River. (Coll. Cope.)
*Alburnellus percobromus*, Cope, Hayden's Geol. Surv. Wyom. for 1870, 440, 1871, Missouri River at St. Joseph, Missouri.
*Alburnellus rubrifrons*, Cope, Cypr. Penn., 388, 1866.
*Leuciscus rubrifrons*, Günther, Cat., vii, 225, 1868.
*Minnilus rubrifrons*, Jordan & Gilbert, Synopsis, 202, 1883.
*Minnilus percobromus*, Jordan & Gilbert, Synopsis, 202, 1883.

### 490. NOTROPIS PHOTOGENIS (Cope).

Head 4¼; depth 5½; eye 3. D. 8; A. 10; scales 6–40–3. Body slender, compressed, the form similar to that of *N. rubrifrons*. Head moderate. Mouth quite oblique, lower jaw scarcely projecting; maxillary about reaching orbit. Back broad. Dorsal fin inserted behind middle of body, a little behind ventrals. Scales before dorsal 25. Lateral line decurved. Eye larger than in N. *rubrifrons*. Color olivaceous, with brown vertebral and dorsal lines; sides and below, bright silvery, with dark specks along the lateral line; none along base of anal. Length 3 inches. Alleghany region, thus far recorded only from the Youghiogheny and Kanawha, unless *N. amœnus* should prove to be a variety of it. The latter is stouter, with larger eye, and has dark dots along base of anal. Var. *engraulinus*, Cope, from the Kanawha is slenderer, the depth 6 in length, the head 3⅔. (*φῶς*, light; *γένειον*, cheek.)

?*Rutilus compressus*, RAFINESQUE, Ich. Oh., 51, 1820, Monongahela River, etc.; not identifiable; may be *N. cornutus.*

*Squalius photogenis*, COPE, Proc, Ac. Nat. Sci. Phila., 1864, 280, Youghiogheny River, Penn.

*Photogenis leucops*, COPE, Proc. Ac. Nat. Sci. Phila., 1867, 164., Sinking Creek, and near Austinville, Va. (Coll. Cope.)

*Photogenis leucops engraulinus*, Cope, *l. c.*, 1867, 164, tributaries of Kanawha River, Austinville, Va. (Coll. Cope.)

*Leuciscus photogenis*, GÜNTHER, Cat., VII, 252, 1868.

### 491. NOTROPIS AMŒNUS (Abbott).

Head 4; depth 5⅓, (4¾ to 5½); eye 3⅓. D. 8; A. 10; scales 6–39–3. Close to *Notropis rubrifrons*, but the scales before dorsal smaller, as in *N. photogenis.* Body elongate, compressed; eye large, longer than snout. Mouth large, oblique, the jaws subequal, the maxillary to front of eye; 22 to 25, (rarely 18 to 20) scales before dorsal; lateral line much decurved. Dorsal high, behind ventrals; pectorals moderate. Translucent green, sides silvery, with sometimes a faint plumbeous band ending in an obscure plumbeous spot. Length 3¾ inches. Clear streams east of the Alleghanies from the Raritan to the Neuse; abundant; formerly confounded with *N. photogenis*, of which it may be a variety. (*amœnus*, attractive.)

*Alburnellus amœnus*, ABBOTT, Amer. Nat., VIII, 1874, 334, Raritan River, New Jersey.

*Notropis amœnus*, JORDAN, Bull. U. S. Fish Comm., XIII, 1888, (1891), 102.

### 492. NOTROPIS SCEPTICUS (Jordan & Gilbert).

Head 3¾; depth 4½; eye 3. D. 8; A. 10; scales 6–38–3; teeth 2, 4–4, 1. Body short and deep, compressed and somewhat elevated. Head rather large, deep, bluntish. Mouth moderate, terminal, oblique, lower jaw slightly included; upper lip opposite middle of eye; maxillary extending to front of orbit. Eye very large, longer than snout; interorbital space broad, flattish. Lateral line much decurved. Scales before dorsal large, in 13 to 15 rows. Fins moderate; dorsal well behind ventrals; tips of ventrals extending to last dorsal ray; caudal peduncle moderate. Coloration very pale green; sides with a bright silvery band; scales with very little dark edging; a dark line at base of dorsal; males in spring with the snout profusely tuberculate. Length 3 inches. Rivers of Carolina from the Cape Fear to the Santee; abundant, replacing the allied *amœnus*, from which it differs in the deeper body and larger nuchal scales. (*σκεπτικός*, observant, from the large eye.)

*Notropis photogenis*, ("pale variety"), JORDAN & BRAYTON, Bull. U. S. Nat. Mus., XII, 23, 1878.

*Minnilus scepticus*, JORDAN & GILBERT, Synopsis, 200, 1883, Saluda River, Greenville, South Carolina. (Type, No. 31081. Coll. Jordan & Brayton.)

### 493. NOTROPIS MICROPTERYX (Cope).

Head 4½; depth 5½; eye 3½. D. 8; A. 10; scales 5–38–2. Body very slender, compressed; head moderate, rather pointed. Mouth large, oblique; upper lip on level of pupil; maxillary reaching to opposite front of orbit. Eye moderate, about as long as muzzle. Scales large. Lateral line decurved. Fins all quite small, the dorsal farther back than in related species, so that the short ventrals do not reach much beyond its anterior rays, their length 2 in head. Color olivaceous; sides bright silvery; dorsal scales conspicuously dark-edged; a dusky blotch at base of caudal, underlying the silvery luster. Length 2¾ inches. Head waters of Cumberland and Tennessee rivers and also in the Ozark region; abundant in clear streams in northern Arkansas. (*μικρός*, small; *πτέρυξ*, fin.)

*Alburnellus micropteryx*, COPE, Journ. Ac. Nat. Sci. Phila., 1868, 233, Holston River.
*Minnilus micropteryx*, JORDAN & GILBERT, Synopsis, 203, 1883.

### 494. NOTROPIS METALLICUS, Jordan & Meek.

Head 4; depth 5; eye 3. D. 8; A. 11. scales 5–35–3, 16 before dorsal; teeth 2, 4–4, 2, the grinding surface obsolete. Body elongate, compressed, the back a little elevated. Head small, the snout little acute, shorter than eye, which is large. Mouth large, oblique, the cleft reaching front of eye, 3⅓ in head; chin projecting. Lateral line decurved. Dorsal inserted well behind ventrals; dorsal and anal high, the anal very long. Dark brown, a rosy band from eye to upper lobe of caudal; below this a metallic dusky band broader than eye, ending in a black spot at base of caudal; dorsal with a black band obliquely across it; no spot at its base; other fins nearly plain. Length 1¾ inches. Swamp streams in Georgia and Florida, from the Suwannee Basin to the Escambia. (*metallicus*, metallic.)

*Notropis metallicus*, JORDAN & MEEK, Proc. U. S. Nat. Mus., 1884, 475, Allapaha* River, Nashville, Georgia. (Type, No. 28511. Coll. W. J. Taylor.)

### Subgenus LYTHRURUS, Jordan.

### 495. NOTROPIS BELLUS (Hay).

Head 4¼; depth 3¾. D. 8; A. 10 or 11; scales 7–41–3; teeth 2, 4–4, 2, "sharp-edged, but with a masticatory surface." Body short, deep, considerably compressed; the back elevated. Head short; muzzle short, rather pointed, the profile somewhat concave; mouth large, oblique, the maxillary extending to opposite front of orbit; lower jaw projecting. Lateral line much decurved. Scales crowded forward, 25 in front of dorsal. Dorsal midway between snout and caudal, behind ventrals; pectorals not reaching ventrals; the latter to vent. Dusky above, with a narrow, dark dorsal line; sides silvery, with plumbeous streak; no spot at base of dorsal; fins mostly black-tipped; belly flame color in life; fins orange at base. Length 2½ inches. Tombigbee River, Mississippi. (Hay.) (*bellus*, beautiful.)

*Minnilus bellus*, HAY, Proc. U. S. Nat. Mus., 1880, 510, Tombigbee River, Artesia and Macon, Mississippi. (Type, No. 27426. Coll. Hay.) JORDAN & GILBERT, Synopsis, 199, 1883.

### 496. NOTROPIS LIRUS (Jordan).

Head 4⅓; depth 5¼; eye 3. D. 8; A. 10; scales 8–45–4; teeth 2, 4–4, 2, with very narrow or obsolete grinding surface. Body slim, compressed. Head small, short, moderately deep, flattish above. Mouth rather large, very oblique, the lower jaw slightly projecting. Eye very large, longer than snout; the maxillary about reaching its front. Scales small, loosely imbricated, their outlines extremely distinct. Fins moderate. Coloration very pale translucent green; scales of back finely punctate; sides with a very distinct metallic blue band formed of dark punctulations, this band passing through the eye and snout, forming a most characteristic color marking; a streak of black dots along the bases of dorsal and

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*Not "*Altamaha* River," as misprinted. The Allapaha is a tributary of the Suwannee River.

anal, that on the dorsal suggesting the peculiar spot of *N. umbratilis*; tip of snout black; fins pale olivaceous, red in the males. Males in the spring with the head and antedorsal region profusely tuberculated. Length 2½ inches. Alabama River; abundant in sandy streams. (λειρός, lily-white.)

*Notropis lirus*, JORDAN, Ann. Lyc. Nat. Hist. N. Y., 1876, 342, Etowah River, etc., Rome, Georgia.

*Notropis alabamæ*, JORDAN & MEEK, Proc. U. S. Nat. Mus., 1884, 476, Alabama River, Montgomery, Alabama. (Type, Nos. 35295 and 35297. Coll. McDonald.)

*Minnilus lirus*, JORDAN & GILBERT, Synopsis, 199, 1883.

### 497. NOTROPIS ROSEIPINNIS, Hay.

Head 4½; depth 4; eye 3½. D. 8; A. 11; scales 8–45–3. Body long and slender, much compressed. Mouth large, oblique, the lower jaw somewhat projecting, the maxillary reaching vertical from front of eye. Eye large, slightly longer than snout. Scales small, especially along the back, somewhat higher than long, but not so closely imbricated as in *N. bellus*. Lateral line much decurved. Dorsal far back, midway between pupil and base of caudal, considerably posterior to ventrals; pectorals not reaching ventrals, the latter to vent. Dark; scales above all with black points; a plumbeous lateral band, ending in a vague caudal spot; a narrow dorsal band; a black spot on the upper anterior portion of dorsal and also on anal, each surrounded by a diffuse blotch; tip of ventrals and edge of pectorals dark; vertical fins red. Length 2¼ inches. Sandy streams of the Gulf States, from the Escambia to the Chickasawha. (*roseus*, rosy; *pinna*, fin.)

*Minnilus rubripinnis*, HAY, Proc. U. S. Nat. Mus., 1880, 509, (not *Argyreus rubripinnis*, Heckel = *N. cornutus*), Chickasawha River, Enterprise, Mississippi. (Type, Nos. 27420 and 32302. Coll. Hay.) JORDAN & GILBERT, Synopsis, 198, 1883.

*Notropis roseipinnis*, HAY, in Jordan, Cat. Fish. N. A., 1885, 27, substitute for *rubripinnis*, preoccupied in *Notropis*.

### 498. NOTROPIS UMBRATILIS * (Girard).

(RED-FIN.)

Head 4¼; depth 4 to 4½; eye 3 to 4. D. 7; A. 11; scales 9–40 to 52–3; teeth 2, 4–4, 2. Body compressed, the caudal peduncle long. Head long, conic, rather pointed. Mouth large, moderately oblique, the premaxillary on level of pupil, the maxillary extending to opposite eye; lower jaw somewhat projecting. Eye moderate, about equal to muzzle. Scales closely imbricated, crowded anteriorly, about 30 before dorsal. Dorsal fin high, inserted about midway between ventrals and anal; pectorals not reaching ventrals, the latter to vent; caudal fin long. Coloration dark steel blue above; pale or silvery below; a more or less evident black spot at base of dorsal in front; the fins otherwise all plain. Males with the anterior dorsal region and the head profusely covered with small whitish tubercles, the belly and lower fins being of a bright brick red in the spring. Females very pale olive, sometimes almost colorless. Length 3½ inches. Minnesota to Western New York, (Cayuga Lake), North Carolina, Alabama, and Kansas; generally abundant in small, clear streams. An ornate and excessively variable little fish, of which the following are recognizable varieties.

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* "A comparison of these specimens from the Tennessee River with others from the Roanoke River (*ardens*), the Pamlico and Neuse (*matutinus*), the Wabash in Indiana, (*cyanocephalus*) [rather *lythrurus*; *cyanocephalus* came from Racine, Wisconsin], various streams in Illinois (*atripes*), and the Arkansas River (*umbratilis*) [= *nigripinnis*], has shown the impossibility of recognizing any of these forms as distinct species. *Matutinus* is smaller and paler than *ardens* and shows less brilliant coloration, these differences being apparently dependent on the sluggish character of the streams it frequents, with their frequent sandy stretches. The resemblance between specimens from the Roanoke and the Tennessee is very close. Both have larger mouth and eye, more brilliant coloration, and more elongate form than in specimens from the north and west. Our specimens from the Tennessee, however, average distinctly deeper than typical *ardens*, and are further characterized by the presence, in males, of several (5 to 8) dark steel blue, vertical bars, irregular in position and shape. This form I here distinguish provisionally as subspecies *fasciolaris*. In Tennessee and Kentucky it undoubtedly passes insensibly into the form common in tributaries of the Ohio and Mississippi (*cyanocephalus*, *atripes*), which shows usually an evidently deeper body, a smaller eye, and a tendency to the accumulation of black pigment in the tips of the ventrals and the anterior rays of the dorsal and anal. Typical *umbratilis* from Kansas and Arkansas appears very distinct from the more easterly form. It has the larger eye of *fasciolaris*, a very deep body, and adult males have all the fins largely black and the sides uniform dusky. Furthermore, the black spot at the base of the anterior dorsal rays, so characteristic of related forms, is here indistinct or wanting. In Iowa and Missouri, however, *umbratilis* appears to pass imperceptibly into *cyanocephalus*, some specimens lacking the dorsal spot, while others from the same locality, and not otherwise differing, have it well developed.

"I have thought it best, therefore, to consider all these forms as poorly defined varieties of a single widespread species, which may stand provisionally as *N. umbratilis umbratilis*, *N. umbratilis cyanocephalus*, *N. umbratilis fasciolaris*, *N. umbratilis ardens*, and *N. umbratilis matutinus*. East of the Alleghanies the species has not been recorded north of the Roanoke nor south of the Neuse, and is not known from the Gulf States south of the Tennessee and Arkansas Basins. Rafinesque's *Semotilus diplæmius*, so long identified with this species, is evidently *Semotilus atromaculatus*, as a synonym of which it must appear." (Gilbert, Bull. U. S. Fish Comm., IX, 1889, 148.)

The typical, that is, earliest known form, but the most aberrant of the series, occurs in Iowa and southwestward to the Arkansas Basin.

### 498a. NOTROPIS UMBRATILIS UMBRATILIS (Girard).

Head 4; depth 3⅓ to 3⅗; eye about 4. D. 8; A. 11; scales 40 to 44. Body short, deep and compressed. Eye smaller than in other forms. Lateral line deflexed. Male steel blue, smutty above, a dark curved bar on scapular region; dorsal black except at base mesially, the dark spot in front obscure; lower fins all dusky, flushed with red; females very pale olivaceous, the black scapular bar usually plain, the dark spot represented by dark punctulations. Length 3 inches. Arkansas River and streams of Kansas and southwestern Iowa. (*umbra*, shade.)

*Alburnus umbratilis*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 193, Sugar Loaf Creek, tributary Poteau River, Arkansas. (Type, No. 73. Coll. Möllhausen.)

*Luxilus lucidus*, GIRARD, Proc. Ac. Nat. Sci. 1856, 203, Coal Creek, tributary South Fork Canadian River. (Coll. Möllhausen.)

*Minnilus nigripinnis*, GILBERT, Bull. Washb. Lab. Nat. Hist., 1, 1884, 14, Shunganunga Creek, near Topeka, Kansas. (Type, No. 36613. Coll. Cragin.)

? *Notropis macrolepidotus*,* FORBES, Bull. Ill. Lab. Nat. Hist., 1885, 138, Illinois. (Coll. Forbes.)

*Alburnellus umbratilis*, GIRARD, Pac. R. R. Surv., x, 260, 1858.

*Minnilus umbratilis*, JORDAN & GILBERT, Synopsis, 200, 1883.

*Notemigonus lucidus*, JORDAN & GILBERT, Synopsis, 249, 1883.

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* The following is Prof. Forbes' account of *Notropis macrolepidotus*: This fish, represented by a single specimen in our collections from Illinois, closely resembles *Notropis atripes*, from which it differs especially in the larger scales, and in the entire absence of any blotch at the front of the base of the dorsal fin. It is elliptical in outline, strongly compressed, its greatest thickness being less than half its depth, the back making a uniform curve from the front of the dorsal to the nostrils. Length 2.1 inches, depth 4.2 in length, caudal peduncle 4.6. Color in alcohol plain, the sides somewhat silvery, the opercles brightly so; no dark vertebral line, but the scales upon the back and upon the upper part of the sides thickly sprinkled with rather large circular black specks; fins all plain; upper surface of the head a little dusky, and thickly sprinkled with black. The head is a compressed cone, 4.5 in length, upper surface convex; snout regularly decurved, 3.5 in head; mouth rather large, terminal, oblique; upper lip opposite the middle of the pupil; maxillary to posterior margin of nostril; upper jaw 3.15 in head, lower not projecting, 2.6 in head; teeth 4, 2-2, 4; eye large, circular, 3.75 in head; dorsal fin I-8, about 4 scales behind the ventrals; anal 11; scale formula 6-40-3, 19 before dorsal.

Further eastward in Illinois and Iowa in prairie brooks occurs

### 498b. NOTROPIS UMBRATILIS ATRIPES (Jordan).

Head 4⅓; depth 4; eye 4. D. 7; A. 11; scales 9–52–5. Body very strongly compressed. Head comparatively pointed; eye small, shorter than muzzle. Coloration of body dark bluish, without traces of vertical bars; sides not silvery, the scales dusted with dark punctulations; dorsal with the usual black spot at base in front, smaller than in *lythrurus* or *ardens*; a black bar crosses its upper part; anal colored like the dorsal, with a black spot at base in front, the markings paler; ventral fins dusky; males profusely tuberculate, and doubtless red in spring. Length 3 inches. Southern Illinois and Iowa. (*ater*, black; *pes*, foot.)

*Lythrurus atripes*, Jordan, Bull. Ill. Lab. Nat. Hist., II, 59, 1878, streams of Union and Johnson counties, Illinois. (Type, No. 26295. Coll. Forbes.)
*Minnilus atripes*, Jordan & Gilbert, Synopsis, 197, 1883.

Represented throughout the Ohio Valley and neighboring regions by

### 498c. NOTROPIS UMBRATILIS LYTHRURUS (Jordan).

The central type from which the others seem to have diverged. Body moderately elongate, the depth 4¼ in length, the females nearly 5; eye large, about 3½ in head. Scales 9–47–3. Dorsal with a conspicuous black spot in front, the rest of the fin mostly pale; no anal spot. Length 3½ inches. Ohio Valley and rivers of neighboring states. (*λύθρον*, blood; *οὐρά*, tail.)

*Rutilus ruber**, Rafinesque, Ich. Oh., 52, 1820, Elkhorn and Kentucky rivers; named but not described.
*Notropis lythrurus*, Jordan, Proc. U. S. Nat. Mus., 1884, 476, White River, Indianapolis, Indiana. (Type, No. 20115. Coll. Jordan & Copeland.)
*Hypsilepis diplæmia*, Cope, Proc. Ac. Nat. Sci. Phila., 1867, 162.
*Minnilus diplæmius*, Jordan & Gilbert, Synopsis, 197, 1883; not *Semotilus diplæmius*, Rafinesque.

Represented northward by the deep-bodied

### 498d. NOTROPIS UMBRATILIS CYANOCEPHALUS (Copeland).

Head 4⅛; depth 4; eye 3⅓. D. 8; A. 12; scales 9–46–4; teeth 2, 4–4, 2. Body short, stout, chubby, moderately compressed, the form resembling that of *Pimephales*. Head very short, deep, its greatest depth three-fourths its length. Snout blunt, shorter than eye. Eye large, not so wide as the interorbital space. Coloration dark bluish above; sides not silvery; males in spring profusely covered with small tubercles; the sides and fins clear, bright red; the back, and especially the top of the head, of a clear glaucous blue; dorsal in both sexes with a large black spot at the base of its anterior rays, this spot about as large as eye; dorsal, anal, and ventrals blackish at tip. Length 2⅓ inches. Rivers of southern Wisconsin, etc. (*κυάνεος*, blue; *κεφαλή*, head.)

*Lythrurus cyanocephalus*, Copeland, Proc. Ac. Nat. Sci. Phila., 1877, 70, Racine River, Wisconsin. (Type, No. 17857. Coll. Hoy & Copeland.)
*Minnilus cyanocephalus*, Jordan & Gilbert, Synopsis, 196, 1883.

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* "51st species, Red Minny, *Rutilus? ruber*, Rutile rouge. Entirely red; tail forked. I add here a fine small fish, which I have never seen as yet, but it is said to live in the small streams which fall into the Elkhorn and Kentucky. It is a slender fish, only 2 inches long, compressed, and of a fine purple red. It may belong to this genus, or to any other of this tribe. It is commonly called Red Minny."—*Rafinesque.*

Represented east of the Alleghanies by the slim-bodied

### 498e. NOTROPIS UMBRATILIS ARDENS (Cope).

Slender and brilliantly colored, the depth 4⅗ in males; eye 3½ in head. Steel blue, the fins bright red, base of dorsal largely black. Roanoke River, Virginia. A beautiful inhabitant, with *Notropis cerasinus*, of the clear mountain streams. (*ardens*, burning.)

*Hypsilepis ardens*, COPE, Proc. Ac. Nat. Sci. Phila., 1867, 163, headwaters of Roanoke River, Montgomery County, Virginia. (Coll. Cope.)
*Leuciscus ardens*, GÜNTHER, Cat., VII, 257, 1868.
*Minnilus ardens*, JORDAN & GILBERT, Synopsis, 198, 1883.

Represented in Tennessee and northern Alabama by

### 498f. NOTROPIS UMBRATILIS FASCIOLARIS, Gilbert.

Body usually deep, the males with 5 to 8 dark blue vertical crossbars as in *Notropis cerasinus*. Colors brilliant. Southern bend of Tennessee River, in limestone streams; abundant. (*fasciolaris*, with small cross bands.)

*Notropis umbratilis fasciolaris*, GILBERT, Bull. U. S. Fish Comm., IX, 1889, (1891), 148, streams about Florence, Alabama. (Type, No. 42504. Coll. Gilbert & Swain.)

Represented in the Carolina pine woods by the slender and pale

### 498g. NOTROPIS UMBRATILIS MATUTINUS (Cope).

Head 4¼; depth 5½; eye 3½. D. 8; A. 11; scales 7-44-3. Body slender; eye large, scarcely longer than muzzle, equal to interorbital width. Olivaceous above; the scales brown-shaded; a plumbeous lateral band with dark points; a small black spot at base of dorsal in front, preceded by a dark streak along middle of back; a dark spot at base of caudal. Males with the snout, chin, and upper half of dorsal red. Length 2½ inches. Neuse and Pamlico rivers; common in sandy brooks, with *Notropis albeolus*. (*matutinus*, of the morning, rosy.)

*Alburnellus matutinus*, COPE, Proc. Amer. Phil. Soc. Phila., 1870, 465, Neuse River, Wake County, North Carolina. (Coll. Cope.)
*Minnilus matutinus*, JORDAN & GILBERT, Synopsis, 199, 1883.
*Notropis matutinus*, JORDAN, Bull. U. S. Fish Comm., VIII, 1888, 125.

Represented in tributaries of the lower Mississippi by the deep-bodied

### 498h. NOTROPIS UMBRATILIS PUNCTULATUS (Hay).

Head 4⅗; depth 4⅓; eye moderate, 3. D. 8; A. 10 or 11; scales 11-49-3; teeth 2, 4-4, 2, with grinding surface. Body short, deep, compressed; back elevated in front of dorsal. Head short and deep; the profile nearly straight; mouth large, quite oblique, maxillary reaching front of orbit. Scales small, 25 in front of dorsal. Lateral line much decurved. Dorsal beginning midway between muzzle and base of caudal. Straw color; silvery on sides and below; scales above dark-edged; a dark dorsal line; a dark band on caudal peduncle; a small black spot at base of dorsal. Length 2 inches. Tributaries of Big Hatchee River, northern Mississippi. (Hay.) (*punctulatus*, speckled.)

*Minnilus punctulatus*, HAY, Proc. U. S. Nat. Mus., 1880, 508, Tuscumbia River, a tributary of the Big Hatchee, near Corinth, Mississippi. (Type, No. 27430. Coll. Hay.)
*Minnilus punctulatus*, JORDAN & GILBERT, Synopsis, 198, 1883.

## 124. ERICYMBA, Cope.

*Ericymba*, COPE, Proc. Ac. Nat. Sci. Phila., 1865, 88, (*buccata*).

Body rather elongate, little compressed; muzzle broad. Premaxillary protractile. Interopercle, suborbital, and dentary bones containing conspicuous, externally visible, mucous channels; lips thin; no barbel. Teeth 1, 4–4, 0, without grinding surface, hooked, the edges entire. Scales rather large; the lateral line continuous. Dorsal fin above ventrals. Anal basis short. Silvery fishes of small size, known at once from all other minnows by the cavernous bones of the lower part of the head. One species known; a curious and interesting little fish of the larger creeks. (*ἐρι-*, an intensive particle; *κύμβη*, a cavity; in allusion to the development of the mucous channels.)

### 499. ERICYMBA BUCCATA, Cope.

Head 4; depth 5; eye large, 4 in head. D. 8; A. 8; scales 5–33–3; teeth 1, 4–4, 0. Body fusiform, rather elongate, little compressed, the back not elevated. Head rather long, somewhat depressed above, with broad and prominent muzzle. Mouth rather small, horizontal, subinferior, the lower jaw considerably shorter than upper; upper lip below level of pupil; maxillary not reaching to eye; dentary bones dilated, the mucous channels conspicuous. Suborbital very broad, silvery, with an elevated longitudinal ridge and conspicuous cross lines; opercle small. Fins small, dorsal over ventrals. Scales moderate; lateral line nearly straight; breast scaleless; 15 large scales before dorsal. Color olivaceous, rather pale; sides bright silvery with bluish reflections; a dark dorsal streak, conspicuous posteriorly; fins plain: males without tubercles or bright colors. Length 3 to 5 inches. Michigan and western Pennsylvania to Kansas and southward to West Florida; locally very abundant. One of the most remarkable of our little minnows. (*bucca*, cheek.)

*Ericymba buccata*, COPE, Proc. Ac. Nat. Sci. Phila., 1865, 88, Kiskiminitas River, western Pennsylvania, a tributary of the Monongahela. (Coll. Cope); COPE, Cypr. Penn., 361, 1866; GÜNTHER, Cat., VII, 185, 1868; JORDAN & GILBERT, Synopsis, 204, 1883.

## 125. PHENACOBIUS, Cope.

*Phenacobius*, COPE, Proc. Ac. Nat. Sci. Phila., 1867, 96, (*teretulus*).
*Sarcidium*, COPE, Hayden's Geol. Surv. Wyom. for 1870, (1871), 440, (*scopiferum*).

Body elongate, little compressed. Head moderate, subterete; mouth inferior, the lower lip thin mesially, but enlarged into a fleshy lobe on each side toward the angle of the mouth, thus presenting a superficial resemblance to that of *Exoglossum*, with which the genus has probably real affinities; upper lip with a callous covering within; dentary bones distinct, except at symphysis. No barbel. Upper jaw protractile. Teeth 4–4, hooked, without grinding surface. Scales rather small; lateral line complete. Dorsal fin in front of ventrals; anal basis short. Isthmus extremely wide. Intestines short; peritoneum white. Small species, with the aspect of young suckers. (*φέναξ*, deceptive; *βίος*, life; the appearance of the fish suggesting an herbivorous species with long intestines, which it really is not.)

*a.* Scales moderate, 42 to 53 in the lateral line.
  *b.* Breast scaly; no distinct spot at base of caudal. TERETULUS, 500.
  *bb.* Breast naked; caudal spot very distinct.
    *c.* Scales in lateral line 49 to 53, their outlines blended. MIRABILIS, 501.
    *cc.* Scales in lateral line 43 to 45, their outlines emphasized by dark edgings. SCOPIFER, 502.
*aa.* Scales small, about 60 in the course of the lateral line; breast naked.
    *d.* Body very slender; base of caudal with a distinct black spot. URANOPS, 503.
    *dd.* Body moderately slender; base of caudal with a vague dusky blotch. CATOSTOMUS, 504.

### 500. PHENACOBIUS TERETULUS, Cope.

Head 4⅔; depth 4⅔; eye large, high up, 3½ in head. D. 8; A. 7; scales 6–43–5; teeth 4–4. Body slender, little compressed, the back not elevated, the caudal peduncle stout. Head stout, the muzzle elongate, obtusely decurved, heavy. Mouth small, inferior, horizontal, the maxillary not reaching to eye. Isthmus wide. Breast scaly. Lateral line nearly straight. Pale yellowish; the scales above dark-edged; snout blackish; a plumbeous lateral band; fins plain. Length 3½ inches. Kanawha River; not common. (*Teretulus*, an old name of the Red Horse, *Moxostoma*.)

*Phenacobius teretulus*, COPE, Proc. Ac. Nat. Sci. Phila., 1867, 96, Kanawha River, Eggleston Springs, West Virginia. (Coll. Cope.) JORDAN & GILBERT, Synopsis, 204, 1883.

### 501. PHENACOBIUS MIRABILIS (Girard).

Head 4⅓; depth 4½; eye large, 4 in head. D. 8; A. 7; scales 7–48 to 52–5. Body moderately slender. Head short, rather blunt anteriorly. Mouth small, the maxillary not reaching to eye. Pale olivaceous; a silvery lateral band and a conspicuous black spot at base of caudal, smaller than eye; outlines of scales blended, not emphasized by dark edgings. Fins pale. Length 3½ inches. Illinois River to Arkansas, rather common in sandy streams; specimens examined from the Illinois, Des Moines, Osage, Missouri, Arkansas, and Sabine rivers. (*mirabilis*, wonderful.)

*Exoglossum mirabile*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 191, and Pac. R. R. Surv., x, 256, 1858, Arkansas River, Fort Smith. (Coll. Shumard.)

*Phenacobius mirabilis*, JORDAN & GILBERT, Synopsis, 205, 1883; JORDAN & MEEK, Proc. U. S. Nat. Mus., 1885, 6.

### 502. PHENACOBIUS SCOPIFER (Cope).

Head 4 to 4¼; depth 4¼; scales 6–43 to 45–5. Very close to the preceding, differing so far as known only in the larger scales, the outlines of which are sharply defined on account of dark edgings. Caudal spot distinct. Illinois to the Rio Grande, about as abundant as the preceding, perhaps more widely distributed. It is possible that this form represents simply the extreme of variation of *P. mirabilis*. (*scopifer*, bearing a stem.)

*Sarcidium scopiferum*, COPE, Hayden's Geol. Surv. Wyom. for 1870, (1871), 440, Missouri River, near St. Joseph, Missouri.

*Phenacobius teretulus liosternus*, NELSON, Bull. Ill. Lab. Nat. Hist. I, 1876, 46, brooks of McLean County, Illinois.

*Phenacobius scopiferus*, JORDAN, Bull. Hayden's Geol. Surv., IV, 666, 1878.

*Phenacobius mirabilis*, in part, JORDAN & GILBERT, Synopsis, 205, 1883.

### 503. PHENACOBIUS URANOPS, Cope.

Head 4¾; depth 6; eye 3½. D. 8; A. 7; scales 7–60–6; teeth 4–4. Body very slender, little compressed; back not elevated, caudal peduncle long and slender. Head long and rather slender, flat above, the muzzle broad, blunt, and projecting. Mouth entirely inferior, larger than in the other species, with conspicuous lips. Eye large, placed high, behind middle of head. Scales small, 24 in front of dorsal. Lateral line straight. Breast and middle line of belly naked; width of isthmus half length of head. Fins small. Color pale olivaceous, with a distinct dark spot at base of caudal. Upper Tennessee Basin, rather common in river channels, not ascending brooks. (*οὐρανός*, sky; *ὤψ*, eye; = stargazer.)

*Phenacobius uranops*, Cope, Proc. Ac. Nat. Sci. Phila., 1867, 96, Holston River, Saltville, Virginia; (Coll. Cope); Jordan & Gilbert, Synopsis 206, 1883; Jordan, Bull. U. S. Fish Comm., VIII, 1888, 146.

### 504. PHENACOBIUS CATOSTOMUS, Jordan.

Head 4½ to 5; depth 5⅔; eye 3½. D. 8; A. 7; scales 7–60–5; teeth 4–4. Body rather slender, nearly terete, scarcely compressed; back not elevated; caudal peduncle stout. Head deep, the muzzle blunt and heavy, the cheeks tumid. Mouth small, inferior, altogether below level of eye, the maxillary barely reaching nostrils; lips much thinner than in *P. uranops*. Eyes large, high up, behind middle of head. Scales small, thin, loosely imbricated; back and belly scaled; breast naked. Lateral line nearly straight; 22 scales in front of dorsal. Fins all small. Width of isthmus 2½ to 3 in head. Pale olivaceous; white below; a silvery lateral band, underlaid by dusky, which forms vague blotch at base of caudal; back dusted with dark specks; top of head black; a yellowish vertebral line. Length 4 inches. Alabama Basin, rather common. (*Catostomus*, a sucker, which it much resembles.)

*Phenacobius catostomus*, Jordan, Ann. Lyc. Nat. Hist. N. Y., 1876, 332, Etowah and Oostanaula rivers, Rome, Georgia. (Type, No. 17889. Coll. Jordan & Gilbert.) Jordan & Gilbert, Synopsis, 206, 1883.

## 126. EVARRA, Woolman.

*Evarra*, Woolman, Bull. U. S. Fish Comm., XIV, 1894, May 3, 1894, 64, (*eigenmanni*).

Body long and low, formed as in *Tiaroga*, subterete and covered with very small scales. Head small, bluntish and thick at tip; mouth very small, terminal, oblique, without barbels, the lips thickish; the upper jaw protractile, but not much movable. Eye moderate; isthmus moderate; lateral line complete. Dorsal low, inserted rather posteriorly; anal small and short. Teeth small, 4–4. Intestine about as long as body. One species known, from Mexico. (*Evarra*, an Indian name, "maker of gods in lands beyond the sea.")

### 505. EVARRA EIGENMANNI, Woolman.

Head 4¼; depth 5⅓; snout 3¼ in head; eye small, 4. D. 8; A. 7; scales about 17–88–10; teeth 4–4; intestine as long as body. Body long and low, subterete, looking like a small sucker; head small, the snout anteriorly truncate, the interorbital space broad and flattish; mouth short, mostly anterior, the maxillary not reaching to eye; premaxillary protractile, but not much movable; lips somewhat thickened; scales very small, those on belly and before dorsal minute; lateral line complete, decurved anteriorly; fins all very small, the dorsal slightly behind ventrals, its tip not pointed; pectorals short, reaching about half way to anal. Olivaceous, belly silvery, sides with a rather faint plumbeous lateral band ending in a small black caudal spot; a darker dorsal stripe; fins all pale. Length 3 inches. City of Mexico; here described from one of Mr. Woolman's types. (Named for Dr. Carl H. Eigenmann.)

*Evarra eigenmanni*, WOOLMAN, Bull. U. S. Fish Comm., XIV, 1894, May 3, 1894, 64, City of Mexico. (Type, No. 45571. Coll. Woolman & Cox.)

## 127. TIAROGA, Girard.

*Tiaroga*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 204, (*cobitis*).

Body decidedly elongate, having the form of a loach (*Cobitis*), subfusiform, little compressed and covered with minute scales. Lateral line complete. Head small, subconical, depressed, the mouth very small, terminal, oblique, without barbels, the lips fleshy and the premaxillary not protractile. Eye moderate. Isthmus very wide. Dorsal inserted slightly behind ventrals, the fin high, its first rudimentary ray somewhat enlarged; anal with short base. Teeth very small, apparently 1, 4–4, 1, and without grinding surface. One species known, a very singular little fish from the Gila region. (A coined name.)

### 506. TIAROGA COBITIS, Girard.

Head 4¾; depth 6; eye 3¾. D. 8; A. 7; lateral line 65. Teeth without grinding surface, 1, 4–4, 1.* Maxillary falling far short of eye, 4 in head; lower jaw included. Eye moderate, high up, midway in head; isthmus very wide. Lateral line nearly straight. Body olivaceous, with dusky specks above; a black spot at base of caudal. Length 2½ inches. Rio San Pedro, a tributary of Rio Gila; only the types yet known. (*cobitis*, the loach, a European fish of similar form.)

*Tiaroga cobitis*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 204, Rio San Pedro, Arizona. (Coll. Clark.) GIRARD, U. S. Mex. Bound. Surv., Ichth., 60, 1859.
*Leuciscus cobitis*, GÜNTHER, Cat., VII, 247, 1868.
*Cliola cobitis*, JORDAN & GILBERT, Synopsis, 170, 1883.
*Tiaroga cobitis*, JORDAN, Proc. U. S. Nat. Mus., 1885, 126.

## 128. RHINICHTHYS, Agassiz.

### (BLACK-NOSED DACE.)

*Argyreus*, HECKEL, Russeggers Reisen, I, 1040, 1843, (*atronasus*), name preoccupied in Entomology.
*Rhinichthys*, AGASSIZ, Lake Superior, 353, 1850, (*atronasus*).

Body rather elongate, not much compressed. Mouth small, subinferior, the upper jaw not protractile, the upper lip continuous with the skin of the forehead, forming a very broad frenum; a small or minute barbel terminal on the maxillary. Teeth mostly 2, 4–4, 2 or 1, hooked, without grinding surface. Intestinal canal short. Scales very small; lateral line continuous. Dorsal fin inserted behind the ventrals. Anal basis short.

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*Not 1, 3–3, 1, as stated by Girard.

Coloration dark, the males rosy in spring. Active little fishes inhabiting mountain springs, the species very difficult to distinguish. (*ῥίγ*, snout; *ἰχθύς*, fish; the snout being prominent.)

*a.* Snout long and prominent, projecting notably beyond the mouth, about twice length of eye in adult; barbel evident.
  *b.* Scales 14–65–8 to 14. CATARACTÆ, 507.
  *bb.* Scales 9–60–7. SIMUS, 508.
*aa.* Snout moderate, projecting little beyond the small mouth, its length 1½ times eye in adult; barbel minute or obsolete. ATRONASUS, 509.

### 507. RHINICHTHYS CATARACTÆ (Cuvier & Valenciennes).

(LONG-NOSED DACE.)

Head 4; depth 5; eye 2 in snout, 5 in head. D. 8; A. 7; scales 14–65–8, (62 to 68); teeth 2, 4–4, 2. Body elongate, little compressed, not elevated. Head long, the muzzle flattened, narrowed, and extremely prominent, the mouth being entirely inferior and horizontal. Eye nearly median. Isthmus wide. Barbel evident. Pectoral fins enlarged in males. Insertion of dorsal nearly median. Color olivaceous, paler below, with numerous dusky punctulations; the back often almost black; some of the scales usually irregularly darker, producing a mottled appearance; no distinct black lateral band; young specimens with a dusky lateral shade; a blackish spot on the opercle; males in spring with the lips, cheeks, and lower fins crimson. Length 5 inches. New England to Virginia and Wisconsin; its varieties ranging to Utah and the Columbia Basin, frequenting clear and boisterous streams and rock pools. (*cataractæ*, of the Cataract, the original type being from Niagara Falls.)

*Gobio cataractæ*, CUVIER & VALENCIENNES, XVI, 315, 1842, Niagara Falls. (Coll. M. Milbert.)
*Leuciscus nasutus*, AYRES, Journ. Bost. Soc. Nat. Hist., IV, 1843, 299, West Hartford, Conn.
*Rhinichthys marmoratus*, AGASSIZ, Lake Superior, 354, 1850, Lake Superior. (Type, No. 9053.) Scales smaller, 10–70–10; otherwise similar. GÜNTHER, Cat., VII, 189, 1868.
*Argyreus nasutus*, COPE, Cypr. Penn. 369, 1866.
*Rhinichthys nasutus*, GÜNTHER, Cat., VII, 189, 1868.
*Ceratichthys cataractæ*, GÜNTHER, Cat., VII, 176, 1868.
*Rhinichthys cataractæ*, JORDAN & GILBERT, Synopsis, 207, 1883.

Represented in the Rocky Mountain region on both sides of the divide by

### 507a. RHINICHTHYS CATARACTÆ DULCIS (Girard).

Head 4; depth 5 to 5½. D. 8; A. 7; scales 11 or 12–63 to 70–9 to 12. Body elongate, not elevated. Head long, the muzzle long and projecting, as in *R. cataractæ*, but rather sharper. Barbel evident, but smaller than in *R. cataractæ*. Insertion of dorsal a little farther back than in *cataractæ*, being usually midway between nostril and base of caudal. Silvery; darker above; a dusky lateral shade, at least in the young; males largely rosy. Length 5 inches. Headwaters of the Missouri, Platte, Arkansas, and Rio Grande; also throughout the Columbia basin, and in tributaries of Great Salt Lake, the Jordan, Provo, and Bear rivers, with the species of *Apocope*, which it closely resembles; abundant in swift brooks. (*dulcis*, sweet, first taken in Sweetwater River.)

*Argyreus dulcis*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 185, Sweetwater River, Nebraska. (Type, No. 210 (20225). Coll. Bowman.) JORDAN, Bull. U. S. Fish Comm., IX, 1889, 8.

*Rhinichthys maxillosus*, COPE, Proc. Ac. Nat. Sci. Phila., 1864, 278, Kansas. (Coll. Hammond.) COPE & YARROW, Zoöl. Wheeler Survey, V, 644, 1875.

*Rhinichthys transmontanus*, COPE, Amer. Nat., July, 1879, 441, tributaries of Rio Grande in Colorado and New Mexico. (Type, No. 17084. Coll. Yarrow.)

*Rhinichthys ocella*, GARMAN, Science Observer, 1881, 58, Northeastern Wyoming and Montana.

*Rhinichthys luteus*, GARMAN, Science Observer, 1881, 59, Bear River, Ogden, Utah; scales below lateral line about 14.

*Rhinichthys dulcis*, JORDAN & GILBERT, Synopsis, 885, 1883; EVERMANN, Bull. U. S. Fish Comm., XI, 1891, (1892), 42.

*Rhinichthys maxillosus* and *transmontanus*, JORDAN & GILBERT, Synopsis, 207, 1883.

### 508. RHINICHTHYS SIMUS, Garman.

Head 4¼. D. 9; A. 8; scales 9–60–7. Head depressed above and in front of eyes; snout rather broad, thin, little projecting. First ray of dorsal midway between eye and base of caudal. Clouded brown, a dark lateral stripe, bordered above by a silver one. Coahuila, Mexico. (Garman); not seen by us. (*simus*, *σίμος*, blunt-nosed, an epithet early applied to Socrates.)

*Rhinichthys simus*, GARMAN, Science Observer, 1881, 61, Coahuila; JORDAN & GILBERT, Synopsis, 886, 1883.

### 509. RHINICHTHYS ATRONASUS (Mitchill).

(BLACK-NOSED DACE.)

Head 4; depth 4½; eye 1½ in snout, 4½ in head. D. 7; A. 7; lateral line 64; teeth 2, 4–4, 2. Body moderately elongate, little compressed. Head moderate, rather broad and flattish above. Snout moderate. Mouth small, horizontal, subterminal, the lower jaw included; barbel minute but probably always present; upper lip on level of the lower part of pupil; maxillary not reaching nearly to eye. Eye small, nearly median. Fins rather small; dorsal fin well back, its insertion about midway between nostril and base of caudal. Scales quite small, somewhat embedded. Color blackish above; some of the scales irregularly darker; a black band passing from snout through eye and along sides of body; a paler streak below this; belly silvery; males in spring with the lateral band and the lower fins, and sometimes the whole body, bright crimson; males in late summer with the lateral band scarlet or orange, the red color growing fainter later in the season. Length 3 inches. New England to Minnesota, Northern Alabama, and Virginia; very abundant in clear brooks and mountain streams. Excessively variable, running into several varieties, the extremes of which seem like distinct species. (*ater*, black; *nasus*, nose.)

*Cyprinus atronasus*, MITCHILL, Trans. Lit. and Phil. Soc. N. Y., I, 1815, 460, Wallkill River; brooks of New York; MITCHILL, Amer. Monthly Mag., I, 1817, December, 289.

*Cyprinus vittatus*, RAFINESQUE, Amer. Monthly Mag. I, 1817, 121, December, Hudson River above the Falls.

*Rhinichthys atronasus*, GÜNTHER, Cat., VII, 191, 1868; JORDAN & GILBERT, Synopsis, 208, 1883.

Represented in the Tennessee Basin by

### 509a. RHINICHTHYS ATRONASUS CROCEUS (Storer).

Head 4; depth 4½; eye 5. D. 7; A. 6; scales 70; teeth 2, 4–4, 2. Very similar to *R. atronasus*, but usually rather stouter, the scales smaller, the barbel more distinct, the head a little shorter, the upper jaw more projecting, and the coloration somewhat different. Back olivaceous, much mottled with darker; sides with a rather faint brownish band, margined above and below with creamy yellowish; a dusky blotch in the middle of the base of the dorsal fin; males with the pectoral fins enlarged, and with the lateral band rosy. Length 3 inches. Tennessee Basin; abundant in clear brooks. (*croceus*, saffron color.)

*Leuciscus croceus*, STORER, Proc. Bost. Soc. Nat. Hist., July, 1845, 48, Florence, Alabama. (Coll. Chas. A. Hentz.)

*Rhinichthys obtusus*, AGASSIZ, Amer. Journ. Sci. Arts, 1854, 357, Huntsville, Alabama; GÜNTHER, Cat., VII, 190, 1868; JORDAN & GILBERT, Synopsis, 208, 1883.

*Rhinichthys badius*, GARMAN, Science Observer, 1881, 60; "Scales 14–80–10," Clinch River.

Replaced northwestward by

### 509b. RHINICHTHYS ATRONASUS LUNATUS (Cope).

Much like var. *croceus*, the coloration mottled, the lateral band obsolete, the mouth more inferior, with shorter and wider cleft. Eye 5 in head; depth 5 in length. Insertion of dorsal midway between nostril and base of caudal. Scales 62. The common form in the lakes and brooks of Michigan and Indiana, and probably of Wisconsin and Minnesota, also.

*Rhinichthys lunatus*, COPE, Proc. Ac. Nat. Sci. Phila., 1864, 278, Grosse Isle, Michigan. (Coll. Prof. Fox.)

*Rhinichthys arenatus*, GARMAN, Science Observer, 1881, 62, Sand Hill River, Minnesota.

Represented in the prairie streams by

### 509c. RHINICHTHYS ATRONASUS MELEAGRIS (Agassiz.)

Similar to subspecies *croceus*, but the jaws nearly equal. Head broad, narrowed anteriorly. Scales 11–70–8. Illinois and Iowa, perhaps indistinguishable from *lunatus*. (*meleagris*, generic name of the turkey, from its color?)

*Rhinichthys meleagris*, AGASSIZ, Amer. Journ. Sci. Arts, 1854, 357, Burlington, Iowa. (Coll. Dr. Rausch.) JORDAN & GILBERT, Synopsis, 886, 1883.

## 129. AGOSIA, Girard.

*Agosia*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 186, (*chrysogaster*).

*Apocope*, COPE, Hayden's Geol. Surv. Mont. for 1871, 472, 1872, (*carringtoni*).

*Eritrema*, COPE, Zoöl. Wheeler's, Geol. Surv. W. 100th Mer., v, 648, 1876, (*henshavii*).

*Zophendum*, JORDAN, Bull. Hayden's Geol. Surv. Terr., IV, 1878, 786, (*siderium*).

This genus differs from *Rhinichthys* only in having the premaxillaries protractile. Even this character shows a disposition to disappear by degrees, as many specimens of *Agosia yarrowi* possess a narrow frenum, which, however, is distinct from the very broad frenum of *Rhinichthys*. In form, appearance, and habits the two groups agree perfectly, all the species inhabiting mountain streams and springs. Rocky Mountain region. (A coined name without meaning.)

APOCOPE, (ἀποκοπη, a cutting away, from the imperfect lateral line):
- *a.* Teeth two-rowed, usually without grinding surface.
  - *b.* Dorsal fin rather low, and not strongly falcate; caudal lobes obtuse.
    - *c.* Snout rather long, less than 4 in head, resembling that of *Rhinichthys.*
      - *d.* Scales small, usually more than 70 in lateral line.
        - *e.* Head 4; snout 4; scales very small, about 89 in lateral line. OSCULA, 510.
        - *ee.* Head rather long, about 4⅛; scales larger, about 78 in lateral line. YARROWI, 511.
        - *eee.* Head shorter, 4½ to 5; scales about 74. COUESII, 512.
      - *dd.* Scales larger, fewer than 70 in lateral line.
        - *f.* Scales about 65; snout 2⅔; eye 5 to 5½. ADOBE, 513.
        - *ff.* Scales large, usually 52 to 65.
          - *g.* Body quite deep, depth 3½ to 4 in length; fins low. NEVADENSIS, 514.
          - *gg.* Body more slender, depth 3¾ to 5 in length.
            - *h.* Scales moderate, usually fewer than 70. NUBILA, 515.
  - *bb.* Dorsal fin high and strongly falcate.
    - *i.* Inner rays of ventral fins without membranous stays joining them to the body.
      - *j.* Eye large, 3 in head; scales large, about 56 in lateral line. VELIFERA, 516.
      - *jj.* Eye smaller, 3½ to 4 in head; scales smaller, 63 to 70 in lateral line. UMATILLA, 517.
    - *ii.* Inner rays of ventral fins united to body by 2 or 3 membranous stays. FALCATA, 518.

AGOSIA:
- *aa.* Teeth one-rowed, 4–4, with grinding surface; scales very small; intestinal canal somewhat elongate. CHRYSOGASTER, 519.

## Subgenus APOCOPE, Cope.

### 510. AGOSIA OSCULA (Girard).

Head 4; depth 4¾; eye 4, shorter than snout. D. 8; A. 7; scales 18–89–15; teeth 1, 4–4, 1. Body rather elongate, the tail stout; muzzle obtuse, but narrowed anteriorly, not overhanging the mouth; barbel small, sometimes obsolete. Scales very small. Dusky olive above, a blackish lateral band; males with axils of pectorals and ventrals scarlet; a scarlet patch above gill opening and one on side of muzzle. Length 2 to 3 inches. Lower Colorado and Gila rivers; not rare. (*osculus*, small mouthed.)

*Argyreus osculus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 186, Babocomori Creek, a tributary of the Rio San Pedro, Arizona. (Type, No. 50. Coll. Clark.) GIRARD, U. S. & Mex. Bound. Surv. Zoöl., 47, plate XXVII, figs. 9 to 12, 1859.

*Argyreus notabilis*, GIRARD, *l. c.*, 1856, 186, Rio Santa Cruz, Sonora, a tributary of the Rio San Pedro, which is a tributary of the Rio Gila. (Coll. Clark.) GIRARD, Mex. Bound. Surv. Zoöl., 47, plate XXVII, figs. 5 to 8, 1859.

*Ceratichthys ventricosus*, COPE, Proc. Amer. Philos. Soc. Phila., 1874, 136, Arizona; Plagop. Ichth. Utah, 10, 1874. (Type, No. 15784. Coll. Newberry.)

*Apocope ventricosa*, COPE & YARROW, Zoöl. Wheeler Surv., 648, plate XXVIII, figs. 1 and 1a, 1875, (1876).

*Apocope oscula* (in part) and *ventricosa*, JORDAN & GILBERT, Synopsis, 211, 1883.

### 511. AGOSIA YARROWI, Jordan & Evermann.

Head 4⅛; depth 5 to 5½; eye 5½ to 6; snout short, obtuse, 2⅔ to 2¾. D. 7; A. 7; scales small, averaging about 16–78–13. Barbel small but distinct. Body elongate, little compressed; head long and rather heavy, bluntish, upper lip with or without narrow frenum joining it mesially to snout; the frenum present in about half of our many specimens; lips full, maxillary about 3½ in head. Lateral line complete. Dorsal fin well backward, its origin about midway between base of caudal and eye;

pectoral 1⅓ in head, usually not quite reaching ventrals, the latter reaching past vent; caudal large. Color dark olive, more or less mottled above with black; sides with two ill-defined dark lateral bands, the interspaces paler; axils of the fins mostly crimson in life, as in related species. Length 2 to 5 inches. Streams of Colorado in the Colorado River Basin, very abundant in small streams in the mountain meadows, less common in the larger streams. (Named for Dr. Henry C. Yarrow, naturalist of the Survey West of the Hundredth Meridian.)

*Agosia yarrowi*, JORDAN & EVERMANN, Bull. U. S. Fish Comm., IX, 1889, (1891), 28, Tomichi Creek and Gunnison River, Gunnison, Colorado. (Coll. Jordan, Evermann, Fesler, & Davis.)

*Apocope oscula*, COPE & YARROW, Zoöl. Wheeler Survey, 647, 1875, (1876), not of GIRARD; JORDAN & GILBERT, Synopsis, 211, 1883, in part.

### 512. AGOSIA COUESII (Yarrow).

Head 4 to 4¼; depth 4⅕ to 4½; eye 4½ to 5; snout 2⅘. D. I, 8, (sometimes 7); A. I, 7; scales 12–74–11, (range from 70 to 76); teeth 1 or 2, 4–4, 2 or 1. Barbel present. Body moderately stout, ventral and dorsal outlines gently arched; head long and pointed; snout pointed, mouth broad, inferior; eye small, high up; interorbital width equal to snout; caudal peduncle long, slender, and compressed. Origin of dorsal behind insertion of ventrals, about midway between base of middle caudal rays and nostril. Scales small, firm and close-set; lateral line complete. Color dark gray above and on sides to lateral line; below pale; no lateral band; fins all plain. Length 4½ inches. Colorado River Basin. (Named for Dr. Elliott Coues, the well-known ornithologist.)

*Apocope couesii*, YARROW, Field and Forest, 1876, and Zoöl. Wheeler Surv., 648, 1875, (1876), Camp Apache, Arizona.

### 513. AGOSIA ADOBE, Jordan & Evermann.

Head 3⅔ to 3⅚; depth 4½ to 5; eye 2 in snout, 5 to 5½ in head. D. 8; A. 7; scales 12–63 to 70–10. Body slender and elongate, the head long and low, sharp in profile. Snout long, about 2⅔ in head, its tip projecting considerably beyond the thick upper lip; mouth larger than in *A. nubila*, the maxillary extending beyond nostril; barbel well developed. Lateral line complete. Insertion of dorsal midway between front of eye and base of caudal; pectorals shortish; caudal large. Length 2 to 4 inches. Clay-colored, with a dark lateral band; back with some dark dots. Sevier River, Utah, locally abundant. (*adobe*, clay, in Spanish.)

*Agosia adobe*, JORDAN & EVERMANN, Bull. U. S. Fish Comm., IX, 1889, (1891), 36, Sevier River, Juab, Utah. (Type, No. 41674. Coll. Jordan, Evermann, Fesler, & Davis.)

### 514. AGOSIA NEVADENSIS (Gilbert).

Head 3½ to 4; depth 3½ to 4; eye very small, 5⅓ in head, half interorbital width, which equals distance from tip of snout to middle of eye. D. 8; A. 7; scales 65; pores about 58. Body robust, with broad, heavy head, its greatest depth at occiput, 5 in body, (6¼ in *A. nubila*, of same size). Mouth terminal, very oblique, the lower jaw included, the premaxillaries not overlapped by snout. Maxillary 3 in head, reaching front of eye; barbels well developed; scales small, very irregularly placed, the lateral line incomplete in adult. Fins all small; front of dorsal midway between base of caudal and middle of occiput, behind base of ventrals. Ventral rays apparently seven, the outer rudimentary. Brown, much speckled above, white below, a dark lateral stripe ending in an obscure caudal spot. Warm springs in the deserts of southwestern Nevada; Ash Meadows, Indian Creek, and Vegas Creek, Nevada.

*Rhinichthys (Apocope) nevadensis*, GILBERT, Death Valley Expedition, 230, pl. VI, fig. 1, 1893, Ash Meadows, Amargosa Desert. (Coll. Merriam & Bailey.)

### 515. AGOSIA NUBILA (Girard).

Head $3\frac{3}{4}$ to $4\frac{3}{5}$; depth $3\frac{3}{4}$ to 5; eye $3\frac{1}{2}$ to 5; snout $2\frac{3}{4}$ to $3\frac{1}{3}$. Dorsal usually 8, sometimes 9, one or two rudimentary anterior rays; anal 7; scales variable, ranging from 47 to 70, usually between 52 and 65. Teeth 1, 4–4, 1; 1, 4–4, 0; 1, 4–4, 2; or 2, 4-4, 2. Barbel usually present, especially in coastwise specimens. Body not compressed, head rather short, snout moderate, mouth inferior, horizontal or oblique. Fins not falcate; origin of dorsal usually somewhat behind insertion of ventrals and usually midway between base of middle caudal rays and posterior edge of preopercle, but varying either way as much as diameter of eye. Color usually dark grayish above, becoming paler below, a faint lateral band of dark, extending through eye and around snout, especially plain in specimens from the heavily wooded region of western Washington. An extremely abundant and variable species, and a study of a large amount of material from many different localities in the Columbia River basin has not enabled us to recognize any differences of value for purposes of specific separation. Length $3\frac{1}{2}$ inches. Basin of the Columbia River from western Idaho, below the Shoshone Falls of Snake River to the coast, and in coastwise streams from Washington southward into Oregon. Specimens from the following localities are included under this species in the above description: Clearwater River, Potlatch Creek, near Lewiston, Idaho; Boise River, Caldwell, Idaho; Pataha River, Starbuck, Washington; Umatilla River, Pendleton, Oregon; Mill Creek, Walla Walla; Walla Walla River, Wallula, Washington; Cœur d'Alene Lake, Idaho; Little Spokane River, Spokane, Washington; Hangman Creek, Tekoa, Washington; Columbia River Umatilla, Washington; Colville River, Colville, Washington; Natchess River, North Yakima, Washington; Newaukum River and Skookumchuck River, Chehalis, Washington. (*nubilus*, dusky.)

*Argyreus nubilus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 180, and Pac. R. R. Surv., 244, 1858, Fort Steilacoom, Puget Sound. (Type, No. 51. Coll. Suckley.)
*Apocope nubila*, JORDAN & GILBERT, Synopsis, 210, 1883.
*Agosia nubila*, GILBERT & EVERMANN, Investigations in Columbia River Basin, 41, 1894.

Represented eastward by

### 515a. AGOSIA NUBILA CARRINGTONII (Cope).

Head $3\frac{4}{5}$ to $4\frac{3}{5}$; depth $4\frac{2}{5}$ to 5; eye 4 to $4\frac{3}{5}$; snout 3 to $3\frac{1}{3}$. D. I, 9, rarely I, 8; A. I, 7; scales 64, (53 to 72). Barbel usually present. Teeth variable, but usually 1, 4–4, 2, hooked. Body rather stout, back little elevated, caudal peduncle compressed; head moderate, snout broad, gently decurved; mouth broad, inferior, oblique; interorbital width equals length of snout. Fins not falcate; insertion of dorsal slightly behind ventrals, about midway between base of middle caudal rays and pupil; height of dorsal and anal about equal, 1⅙ in head; caudal not deeply forked. Lateral line often, but not always, incomplete. Color grayish, with scattered dark spots or blotches; faint dark lateral band extending forward through eye and around snout; dorsal and anal fins with some dark markings; other fins plain. Length 4 inches. Upper Snake River Basin to Heart Lake in Yellowstone Park, thence extending southward in the Great Basin to Utah Lake; very abundant and extremely variable. To this form we also refer provisionally specimens from Lake Tahoe and elsewhere in the Lahontan basin, and also those from various coastwise localities in central and southern California, where it is abundant in clear streams and springs as far south as San Luis Obispo. These California and Nevada forms may be distinct species, but if so, we are unable to define them. (Named for Campbell Carrington, naturalist of the Hayden Survey in Utah and Idaho.)

*Apocope carringtonii*, Cope, Hayden's Fifth Annual Report U. S. Geological Survey, 1871, (1872), 472, Warm Springs, [Box Elder County], Utah. (Coll. Campbell Carrington.) Cope & Yarrow, Zoöl. Wheeler Survey, 645, 1875, (1876).

*Apocope vulnerata*, Cope, *l. c.*, 473, Logan, Utah. (Type, No. 15768. Coll. Henshaw.) Cope & Yarrow, Zoöl. Wheeler Surv., 646, 1875, (1876).

*Tigoma rhinichthyoides*, Cope, *l. c.*, 473, Logan, Utah. (Coll. Carrington.)

*Rhinichthys henshavii*, Cope, Proc. Amer. Philos. Soc. Phila., 1874, 133, Provo, Utah; Plagop. Ichth. Utah, 7, 1874.

*Agosia novemradiata*, Cope, Proc. Ac. Nat. Sci. Phila., 1883, 141, Weber River at Echo, Utah.

*Ceratichthys nubilus*, Cope, Hayden's Fifth Annual Report U. S. Geol. Surv. 1871, (1872), 472.

*Apocope henshavii*, Cope & Yarrow, Zoöl. Wheeler Surv., 645, 1875, (1876).

*Apocope carringtoni* and *vulnerata*, Jordan & Henshaw, Report Chief Engineers, U. S. Geol. Surv. W. 100th Mer., 191, 1878.

*Apocope carringtoni*, *vulnerata*, and *henshavii*, Jordan & Gilbert, Synopsis, 210, 1883.

*Agosia nubila*, Jordan, Bull. U. S. Fish Comm., IX, 1889, (1891), 32 and 48.

*Agosia nubila carringtonii*, Gilbert & Evermann, Investigations in Columbia River Basin, 41, 1894.

### 516. AGOSIA VELIFERA (Gilbert).

Head 4; depth 4¾; eye 3. D. 8; A. 7; lateral line with 56 pores; 10 scales between lateral line and dorsal; teeth 2, 4–4, 2, hooked. Upper lip as in *A. yarrowi* with a narrow frenum, thus indicating a transition toward *Rhinichthys*. Snout narrow, bluntly rounded, not projecting beyond premaxillaries. Mouth small, horizontal, the maxillary equal to eye, reaching front of eye, 3½ in head. Pectorals nearly reaching base of ventrals, the latter beyond front of anal; origin of dorsal behind ventrals, midway between base of caudal and middle of eye, the fin unusually high; caudal lobes more pointed than usual. Brown; a black lateral band and a small black caudal spot. Three specimens from a hot spring in Pahranagat Valley, southwestern Nevada. (*velum*, sail; *fero*, I bear.)

*Rhinichthys* (*Apocope*) *velifer*, Gilbert, Death Valley Expedition, 229, pl. VI, fig. 2, 1893, Pahranagat Valley, Nevada. (Coll. Merriam & Bailey.)

### 517. AGOSIA UMATILLA, Gilbert & Evermann.

Head 4; depth 4¾ to 5; eye 3½ to 4; snout 3. D. I, 9; A. I, 7; scales 13 or 14–63 to 70–7 or 8; teeth 1, 4–4, 1, hooked. Body rather slender, back somewhat elevated; head pointed, narrow; caudal peduncle compressed, its least depth 2 in head. Origin of dorsal fin slightly behind insertion of ventrals, midway between nostril and base of middle caudal rays; dorsal falcate, its anterior rays nearly as long as head; rudimentary rays not much enlarged nor spine-like; anal strongly falcate, the anterior rays much produced, about as long as head; pectorals not quite reaching ventrals, 1¼ in head; ventrals reaching front of anal, 1½ in head; caudal deeply forked. Color as in *A. falcata*, which it resembles, but from which it differs in the absence or very weak development of ventral stays, and in the notably smaller scales. Known from the Columbia River at Umatilla and Payette River at Payette, Idaho. (*Umatilla*, type locality.)

*Agosia umatilla*, GILBERT & EVERMANN, Investigations in Columbia River Basin, 42, pl. IX, fig. 2, 1894, Columbia River, Umatilla, Oregon. (Type, No. 45390. Coll. Gilbert & Rutter.)

### 518. AGOSIA FALCATA, Eigenmann & Eigenmann.

Head 3¾ to 4⅕; depth 4⅓ to 5¼; eye 3½ to 4⅕; snout 2¾ to 3. D. II, 9; A. I, 7; scales 52 to 57. Body slender, caudal peduncle and head very slender; mouth inferior, nearly horizontal, overhung by the rather long snout; eye large, interorbital space wide. Fins falcate; dorsal about over insertion of ventrals, about midway between base of middle caudal rays and pupil, its longest rays nearly as long as head; the two anterior rays strong and spine-like; anal rays about as long as those of dorsal; pectorals variable, usually nearly as long as head; ventrals provided with 2 or 3 membranous stays uniting the inner rays with the body. Dark, mottled above, blotched with dark on sides and at base of caudal fin; head dark above and down to lower level of eye; under parts pale. Fins with some dark markings, especially the caudal; pectorals and ventrals palest. Body and inner sides of pectoral fins often profusely covered with minute tubercles. Columbia River basin; locally abundant; Boise River at Caldwell, Idaho; Payette River at Payette, Idaho; Columbia River at Pasco and Umatilla; and Mill Creek at Walla Walla. (*falcatus*, falcate.)

*Agosia falcata*, EIGENMANN & EIGENMANN, American Naturalist, XXVII, February 4, 1893, 153, Boise River, Caldwell, Idaho. (Coll. Eigenmann.) GILBERT & EVERMANN, Investigations in Columbia River Basin, 42, 1894.

*Agosia shuswap*,* EIGENMANN & EIGENMANN, American Naturailst, XXVII, February 4, 1893, 154, Shushwap Lake, near mouth of Eagle River, British Columbia. (Coll. Eigenmann.)

*Agosia falcata shuswap*, EIGENMANN, Bull. U. S. Fish Comm., XIV, 1894, (July 7, 1894), 111.

#### Subgenus AGOSIA.

### 519. AGOSIA CHRYSOGASTER, Girard.

Head 4; depth 4; eye 4. D. 8; A. 7; scales 88; teeth 4–4, without grinding surface. Barbel small, but evident. Body fusiform; head rather heavy, conical; snout tuberculate in males in spring. Mouth terminal, the upper jaw

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*Dorsal equidistant from base of middle caudal rays and posterior half of eye, inserted directly over origin of ventrals; lateral band well marked, otherwise as in *A. falcata*. (Eigenmann.) Apparently not differing from *A. falcata*.

the longer; maxillary reaching about line of orbit; mouth forming more than a semicircle. Fins long, the ventrals reaching anal. Color, dark iron gray above, sometimes spotted; a darker band of same along sides above lateral line, extending from end of snout to middle of caudal where it is most conspicuous; males with the belly yellow or orange. Tributaries of the Gila River, not rare in mountain brooks. (*χρυσός*, gold; *γαστήρ*, belly.)

*Agosia chrysogaster*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 187, and U. S. & Mex. Bound. Surv., Zoöl., 49, plate xxviii, figs. 5 to 8, 1859, Rio Santa Cruz, Sonora. (Coll. Clark.) Jordan & Gilbert, Synopsis, 209, 1883.

*Agosia metallica*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 187, and U. S. & Mex. Bound. Surv., Zoöl., 49, plate xxviii, figs. 1 to 4, 1859, Rio San Pedro, Arizona. (Coll. Clark.) Jordan & Gilbert, Synopsis, 209, 1885.

*Hyborhynchus siderius*,* (lapsus for *Hybognathus*), Cope, Zoöl. Wheeler Surv., v, 670, plate xxxi, figs. 6, 6a, 1875, (1876), Camp Lowell, Arizona. (Type, No. 16984. Coll. Rutter.)

*Zophendum siderium*, Jordan & Gilbert, Synopsis, 155, 1883.

## 130. HYBOPSIS, Agassiz.

### (Horny-heads.)

*Hybopsis*, Agassiz, Amer. Journ. Sci. Arts, 1854, 358, (*gracilis* = *amblops*).

*Nocomis*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 190, (*nebrascensis* = *kentuckiensis*).

*Ceratichthys*, Baird MS., Girard, Proc. Ac. Nat. Sci. Phila., 1856, 212, (*biguttatus* = *kentuckiensis*).

*Erinemus*, Jordan, Man. Vert., Ed. i, 279, 1876, (*hyalinus* = *amblops*).

*Erimystax*, Jordan, Geol. Surv. Ohio, iv, Zoöl., 858, 1882, (*dissimilis*).

*Yuriria*, Jordan & Evermann, new subgenus, (*altus*).

Body robust, or variously elongate. Mouth terminal or inferior, with lips thin or somewhat fleshy, a conspicuous barbel always present and terminal on the maxillary; a second barbel sometimes present on each side; premaxillaries protractile. Teeth 4–4, or 1, 4–4, 1, or 0; hooked, the grinding surface narrow or obsolete. Scales usually rather large, 35 to 58 in lateral line; lateral line continuous. Dorsal fin inserted over, in front of, or slightly behind ventrals; anal basis short. Males usually with nuptial tubercles, and sometimes flushed with red. A large and varied group, closely allied to *Notropis*, from which it differs chiefly in the presence of the small maxillary barbel. We here divide it into 4 subgenera, but a greater number of subordinate groups could be recognized. The group shows a range of variation as wide as that in *Notropis*, though with a smaller number of species. (*ὑβός*, gibbous; *ὄψις*, face.)

*a.* Species of moderate or small size, the mouth inferior, horizontal; preorbital broad, silvery; sexes similar, the male sometimes tuberculate or with the fins rosy.
  Erimystax, (*ἐρι*, an intensive particle; *μύςταξ*, barbel or moustache):
    *b.* Teeth one-rowed, 4–4; lips thickish; body long and low, with the aspect of *Gobio* or *Phenacobius*.
      *c.* Teeth without grinding surface; sides not marked by a series of dark blotches connected by a lateral band; eye moderate, 3½ to 5½ in head.
        *d.* Scales rather large, 35 to 44 in the lateral line; barbel very long, sometimes duplicated; dorsal fin without black blotch on its upper posterior portion; snout projecting; body slender; fins high.

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* In the type of *H. siderius* the barbel is plainly evident, a fact which Mr. Barton A. Bean has recently kindly verified for us.

*e.* Barbels four; body sprinkled with black dots. TETRANEMUS, 520.

*ee.* Barbels two.

*f.* Back and sides sprinkled with dark dots.

*g.* Lower lobe of caudal pale; snout moderate.

*h.* Eye small, 3½ to 4 in head. ÆSTIVALIS, 521.

*hh.* Eye rather large, 3¼ in head. HYOSTOMUS, 522.

*gg.* Lower lobe of caudal black in life; color of back darker; snout very long. GELIDUS, 523.

*ff.* Back and sides pale, not dusted with dark dots.

*i.* Lower lobe of caudal black in life; eye small, 4½ in head. MEEKI, 524.

*ii.* Caudal fin with both lobes pale; eye larger, 3¾ in head.

*j.* Scales 37. MONTANUS, 525.

*jj.* Scales 45. CUMINGI, 526.

*dd.* Scales small, about 56 in lateral line; dorsal fin with a large black blotch on its posterior rays; a dark spot at base of caudal. MONACUS, 527.

*cc.* Teeth with a slight grinding surface; eye very large, about 2¾ in head; sides with a dark lateral band, expanded at intervals into round dark blotches.

*k.* Scales in lateral line about 44; 17 before dorsal. DISSIMILIS, 528.

*kk.* Scales in lateral line about 50; 20 before dorsal. WATAUGA, 529.

HYBOPSIS:

*bb.* Teeth two-rowed, 1, 4–4, 1 or 0, without grinding surface; mouth small, below the blunt snout; scales large, 34 to 42 in lateral line. Silvery species, with conspicuous preorbital. Aspect of *Notropis.*

*l.* Dorsal fin in adult with a large dark blotch on its last rays above; lips thick, the barbel very long; eye 3⅓ in head. LABROSUS, 530.

*ll.* Dorsal fin plain, without distinct markings.

*m.* Eye moderate, 3¼ to 3½ in head; fins with red in spring males; sides with a dark band ending in a caudal spot.

*n.* Head small, conical; depth 4; scales 5–40–3. HYPSINOTUS, 531.

*nn.* Head larger and less conical; depth 5; scales 5–36–3. RUBRIFRONS, 532.

*mm.* Eye large, 2¾ to 3 in head.

*o.* Sides with a dusky shade; size small, length 2 to 3 inches. AMBLOPS, 533.

*oo.* Sides bright silvery; silvery preorbital broad and conspicuous; size large, 4 to 10 inches or more in adult. STORERIANUS, 534.

YURIRIA, (from Lake Yuriria, Guanajuato, where the typical species abounds):

*bbb.* Teeth one-rowed, 4–4, with broad grinding surface and slight hook; mouth rather large, terminal; scales moderate, about 45; 18 before dorsal. Silvery species, with conspicuous preorbital and very small barbel; size very large. ALTUS, 535.

NOCOMIS:

*aa.* Species of large size, not silvery, with the mouth large, nearly terminal, the dorsal inserted slightly behind ventrals; the teeth 4–4, or 1, 4–4, 1. Eye small; scales in lateral line about 41. Aspect of *Semotilus.* KENTUCKIENSIS, 536.

### Subgenus ERIMYSTAX, Jordan.

### 520. HYBOPSIS TETRANEMUS, Gilbert.

Head 4; depth 5⅓; snout 2½ in head, ⅓ of it projecting beyond mouth; eye small, 5 in head. D. 8; A. 8; lateral line 36 to 38; teeth 4–4. Closely resembling *H. æstivalis* but with two long barbels at each angle of the mouth, the one pair taking the place of the fleshy prominence seen in *gelidus* and *æstivalis*; longest barbel as long as eye. Head very slender, slenderer than in *æstivalis.* Dorsal over ventrals, a little nearer tip of snout than caudal. Fins large. Color as in *æstivalis,* translucent silvery, with irregular, scattered black dots above; median rays of each caudal lobe dusky at base. Length 2 inches. Tributaries of Arkansas River in Kansas and Arkansas; not rare; a most remarkable little fish, the only American minnow with more than two barbels. (*τετρα-*, four; *νῆμα*, barbel.)

*Hybopsis tetranemus*, GILBERT, Bull. Washburn College Lab., 1886, 208, Elm and Spring creeks, Medicine Lodge, Kansas. (Coll. Cragin.)

### 521. HYBOPSIS ÆSTIVALIS (Girard).

Head 3¾; depth 5⅓. D. 8; A. 8; scales 6–36–4; teeth 4–4. Body slender, with long caudal peduncle, the back scarcely elevated. Head long and slender,the snout much projecting and rather pointed. Mouth moderate, inferior, the maxillary reaching posterior nostril. Barbels conspicuous, nearly as long as snout, about 3 in head; each maxillary with but a single one. Eye small, 4 to 4½ in head. Fins rather long, the caudal deeply forked, its lobes subequal; dorsal over ventrals, nearer snout than base of caudal. Color silvery; everywhere sprinkled with small black dots; fins plain. Length 2½ inches. Arkansas River to the Rio Grande, abundant in sandy river channels, not in small brooks. (*æstivalis*, pertaining to summer.)

*Gobio æstivalis*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 189, Rio San Juan, near Cadereita, New Leon. (Coll. Couch.)
*Ceratichythys sterletus*, COPE, Zoöl. Wheeler Survey, v, 652, 1875, (1876), Rio Grande, at San Ildefonso, New Mexico. (Type, No. 16973. Coll. Cope & Shedd.)
*Ceratichthys sterletus* and *æstivalis*, JORDAN & GILBERT, Synopsis, 216, 1883.
*Hybopsis æstivalis*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1886, 8.

Represented in Central Texas by

### 521a. HYBOPSIS ÆSTIVALIS MARCONIS, Jordan & Gilbert.

Eye larger than in *æstivalis*, 3½ in head; caudal peduncle stouter than usual, its least depth half greatest depth of body. Length 3 inches. Abundant in Rio San Marcos, a clear stream issuing from an immense spring at San Marcos, Texas; also known from the Guadalupe River, near San Marcos, and the Rio Comal at New Braunfels.

*Hybopsis æstivalis marconis*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1886, 22, Rio San Marcos, San Marcos, Texas. (Type, No. 36524. Coll. Jordan & Gilbert.) EVERMANN & KENDALL, Bull. U. S. Fish Comm., XII, 1892, (1894), 104, plate 19, fig. 1.

### 522. HYBOPSIS HYOSTOMUS (Gilbert).

Head 4; depth 5½; eye 3¼. D. 8; A. 8; lateral line 37. Body and head very slender; snout long, acute, projecting beyond mouth for half its length; mouth short, wide, inferior; barbel long; pectoral large; other fins small; 13 scales before dorsal. Silvery, everywhere dusted with dark specks; fins pale, the lower lobe of caudal like the other. Length 2½ inches. Indiana to Iowa, and south to the Alabama River; rather common in sandy river channels. (*ὗς*, hog; *στόμα*, mouth.)

*Nocomis hyostomus*, GILBERT, Proc. U. S. Nat. Mus., 1884, 203, White River, Bedford, Indiana. (Type, No. 34980. Coll. Gilbert.)

### 523. HYBOPSIS GELIDUS (Girard).

Head 4; depth 5; eye 6¼; snout 2⅖. D. 8; A. 9; scales 6–44–4. Body slender, not much compressed, back little arched; head long and slender; mouth inferior, horizontal, broad, overhung by the very long, pointed snout, which is considerably decurved; barbel short, 1⅔ in eye; eyes very small, high up, midway of head; interorbital width equal to width of mouth, about 3 in head. Caudal peduncle very long and slender. Fins moderate; origin of dorsal a little nearer snout than base of caudal, directly over base of ventrals; free edge of dorsal fin slightly concave, the anterior ray but little produced, its length 1⅖ in head; free edge of anal little concave, length of first rays 1⅗ in head; pectorals much shorter than in *H. meeki*, 1½ in head, the first rays not produced nor filamentous, and not reaching ventrals; ventrals barely reaching vent, 1⅔ in head; caudal very long and deeply forked, the lobes as long as head, the lower slightly the longer. Lateral line complete, straight; teeth 4–4, strongly hooked. Color, sides silvery, pale below, scales of back each with a group of fine dark specks on posterior border, these extending almost to lateral line; rest of back and upper part of sides sparsely dusted over with minute brownish specks; fins all pale except the caudal, the lower lobe of which is dark, with a narrow white border below; upper lobe slightly dark at base. From *Hybopsis meeki*, which it most closely resembles, this species may be distinguished by the much longer and more pointed snout, the smaller eye, the much shorter pectoral fins, and the darker coloration of the back. Middle Missouri River basin from Wyoming to eastern Nebraska, locally common, but hitherto overlooked; our specimens from Powder River at Arvada, Wyoming, collected by Cox and Gillum. (*gelidus*, frozen.)

*Gobio gelidus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 188, Milk River, Montana. (Coll. Suckley.) GIRARD, Pac. R. R. Surv., 248, 1858.
*Ceratichthys gelidus*, JORDAN & GILBERT, Synopsis, 216, 1883, (in part).

### 524. HYBOPSIS MEEKI, Jordan & Evermann, new species.

Head 4; depth 5½. D. 8; A. 8; lateral line 44. Body very slender, not elevated. Snout long, thick, blunt, overhanging the rather large mouth. Barbel as long as eye. Head slender and elongate. Eye small, rather high, 4½ in head. Mouth small, subterminal, the maxillary not extending to eye. Fins all large; pectoral as long as head; caudal deeply forked. Lateral line decurved; scales rather large. Coloration silvery, unspotted; a dusky lateral streak ending in a blackish spot at base of caudal; lower lobe of caudal abruptly black, edged below with white. Male with the nuptial tubercles excessively developed, covering most of the body. Length 2 inches. Missouri River at St. Joseph and elsewhere, in the river channel; the types (No. 35889) collected by Jordan and Meek. A curious little fish, heretofore confounded with *H. gelidus*. (Named for Dr. Seth Eugene Meek, of the University of Arkansas.)

*Ceratichthys gelidus*, JORDAN & GILBERT, Synopsis, 216, 1883, (in part).
*Hybopsis gelidus*, JORDAN & MEEK, Proc. U. S. Nat. Mus., 1885, 10.

### 525. HYBOPSIS MONTANUS, Meek.

Head 3⅔; depth 5. D. 8; A. 6; scales 4–37–4, 14 before dorsal; teeth 4–4. Body slender, little elongate, the eye high up, 3¾ in head; snout blunt, rather long, 3⅙ in head; mouth rather large, inferior, the lower jaw included; the maxillary past front of eye; barbel long. Dorsal above ventrals; fins moderate. Color plain brownish, without black dots, sides and below silvery; fins plain. Length 2½ inches. Types supposed to be from the upper Missouri.

*Hybopsis montanus*, Meek, Proc. U. S. Nat. Mus., 1884, 526, locality unknown, but collected by Dr. F. V. Hayden. (Type, No. 36882.)

### 526. HYBOPSIS CUMINGII (Günther.)

Head 4⅓; body 5. D. 8; A. 8; scales 6–45–6; teeth one-rowed? Barbels minute. Eye entirely in the anterior half of the length of the head, and nearly as long as the snout, which is obtuse, rounded, convex, the mouth being subinferior. Interobital space convex, as wide as the orbit. Suborbital ring extremely narrow. Origin of dorsal fin a little behind ventrals, somewhat nearer root of caudal than end of snout. Pectorals not reaching ventrals. Olivaceous, a grayish silvery band from gill opening to the root of caudal, where it terminates in a black spot. Length 3½ inches. California, (Günther.) Not seen by us. (Named for H. Cuming.)

*Ceratichthys cumingii*, Günther, Cat., vii, 177, 1868, California, (Coll. H. Cuming); copied in Jordan & Gilbert, Synopsis, 213, 1883.

### 527. HYBOPSIS MONACUS (Cope).

Head 4; depth 5¼. D. 8; A. 8; scales 8–56–4; teeth 4–4. Body slender, somewhat compressed, not much elevated. Head long and rather slender, flattish above, with projecting muzzle; mouth inferior, horizontal, small, the maxillary not reaching the eye, which is quite small, 4⅕ in head. Scales rather small; 24 scales in front of dorsal. Fins moderate. Color light olive; a metallic vertebral band; sides and belly silvery; no lateral band; a conspicuous black spot at base of caudal; muzzle dusky; membrane of upper posterior part of dorsal fin black as in *Notropis whipplii* and related species. Length 4 inches. Tennessee Basin, in the river channels; rather scarce. (*monachus*, *μόναχος*, solitary.)

*Ceratichthys monacus*, Cope, Journ. Ac. Nat. Sci. Phila., 1867, 227, Holston River, Washington County, Virginia. (Coll. Cope.)
*Ceratichthys monachus*, Jordan & Gilbert, Synopsis, 217, 1883.

### 528. HYBOPSIS DISSIMILIS (Kirtland).

(Spotted Shiner.)

Head 4½; depth 5. D. 8; A. 7; scales 6–40 to 47–5; teeth 4–4, often with slight grinding surface. Body long and slender, little compressed, with long caudal peduncle. Head long, rather flat above, the snout somewhat bluntly decurved, projecting a little beyond the rather small, horizontal mouth; lower jaw included; both jaws with the skin hard in front, forming a sort of lip laterally. Barbel considerably shorter than pupil; maxillary not reaching nearly to orbit. Eye very large, high up, somewhat directed upward, rather behind middle of head, forming more than one-third length of head. Opercle small. Dorsal rather large, its posterior border oblique; anal small; caudal well forked; pectoral rather long. Scales rather large, 16 to 18 in front of dorsal. Lateral line nearly straight. Olivaceous; back irregularly mottled; sides silvery, with a bluish lateral band, which is widened into several dusky spots, formed by dark punctulations, and most distinct posteriorly; a dusky band on head, through eyes and snout; fins plain. Length 3 to 4 inches. Lake Erie to the headwaters of the Tennessee, west to Arkansas and Iowa; rather common in the river channels. (*dissimilis*, not similar, to other shiners.)

*Luxilus dissimilis*, KIRTLAND, Bost. Journ. Nat. Hist., III, 1840, 341, pl. IV, fig. 2, Mahoning River, Ohio, and Lake Erie, near Cleveland.

*Ceratichthys dissimilis*, COPE, Cypr. Penn., 367, 1866; GÜNTHER, Cat., VII, 177, 1868; JORDAN & GILBERT, Synopsis, 215, 1883.

### 529. HYBOPSIS WATAUGA, Jordan & Evermann.

Head 4⅓; depth 5½ to 6. D. 7; A. 7; scales 5–48 to 52–4, 20 to 24 before dorsal; teeth 4–4, small, hooked, with slight grinding surface. Body more elongate than in *H. dissimilis*, the scales smaller and the coloration less variegated. Olivaceous, with a bluish lateral stripe not so wide as eye passing around snout; on this stripe 8 to 12 blackish spots, diffuse and smaller than eye, one of these at base of caudal; a dark speck on front of opercle; fins plain. Length 4 inches. Known from Holston River, Virginia; Watauga River, Tennessee; White River, Arkansas; Big Barren River, Kentucky; and Tippecanoe River, Indiana; probably abundant and apparently replacing *H. dissimilis* in mountain streams; size usually larger than in *H. dissimilis*.

*Hybopsis watauga*, JORDAN & EVERMANN, Proc. U. S. Nat. Mus., 1888, 355, Watauga River, Elizabethtown, Tennessee; North Fork Holston River, Saltville, Virginia. (Type, No. 39929. Coll. Jordan, Jenkins, & Evermann.) WOOLMAN, Bull. U. S. Fish Comm., XII, 1892, 258.

### Subgenus HYBOPSIS.

### 530. HYBOPSIS LABROSUS (Cope).

Head 4½; depth 4½. D. 8; A. 7; scales 5–34 to 40–3; teeth 1, 4–4, 1. Body long and slender, little compressed. Head rather long, narrow, and pointed, very slender in young specimens, stouter in adults. Snout decurved in profile, long, overhanging the large mouth; lips much thickened, the lower with an internal fringe of papillæ; barbels extremely long, more than half diameter of eye. Eye moderate, nearly median, 3⅓ in head. Scales moderate, closely imbricated, 16 in front of dorsal. Fins rather small; caudal deeply forked, its peduncle long and slender. Males dark steel blue, with black markings on back and especially at base of dorsal; females very pale silvery, with a blue streak along sides of tail. A small round black spot at base of caudal; a dark lateral streak, obsolete anteriorly; large specimens with a large dark patch on the last rays of the dorsal, as in *Notropis whipplii*; base of the caudal with dark points; males in spring with the head and neck profusely tuberculate and the fins flushed with crimson. Length 3 inches. Basin of the Santee, in North and South Carolina; common. (*labrosus*, thick-lipped.)

*Ceratichthys labrosus*, COPE, Proc. Amer. Phil. Soc., 1870, 458, tributaries of Catawba River, McDowell and Burke counties, North Carolina. (Coll. Cope.)

*Ceratichthys zanemus*, JORDAN & BRAYTON, Bull. U. S. Nat. Mus., XII, 1878, 24, Saluda River, Greenville, North Carolina. (Type, No. 31126. Coll. Jordan & Brayton.)

*Ceratichthys labrosus* and *zanemus*, JORDAN & GILBERT, Synopsis, 217, 1883.

### 531. HYBOPSIS HYPSINOTUS (Cope).

Head 3¾; depth 4. D. 8; A. 8; scales 5–40–3; teeth 1, 4–4, 1. Body stouter, more elevated, and more compressed than in *H. rubrifrons*. Head short, broad above, much smaller and more conical than in *H. rubrifrons*; outline of back rather abruptly declining behind front of dorsal fin, so that the base of the fin is oblique. Mouth inferior, horizontal, small, the maxillary reaching line of orbit. Barbels small. Eye small, 3½ in head. Color silvery, with a double series of black specks along lateral line, and a lateral band of dusted blackish, which passes through eye and snout and ends in a faint caudal spot; males with the fins bright red, and the body with a deep violet luster, as in *Notropis rubricroceus*. Length 3 inches. Santee Basin, in North Carolina and South Carolina; rather rare. Resembles *Notropis procne*, but has an evident barbel. (*ὑψι-*, high; *νῶτος*, back.)

*Ceratichthys hypsinotus*, Cope, Proc. Amer. Phil. Soc. Phila., 1870, 458, tributaries of Catawba River, McDowell County, North Carolina. (Coll. Cope.) Jordan & Brayton, Bull. U. S. Nat. Mus., xii, 1878, 25, and Jordan & Gilbert, Synopsis, 215, 1883.

### 532. HYBOPSIS RUBRIFRONS (Jordan).

Head 4; depth 5. D. 8; A. 7; scales 5–36–3; teeth 1, 4–4, 0. Form of *Hybopsis amblops*. Head long, narrower than in *H. amblops*. Eye moderate, 3⅓ to 3½ in head, wider than the interorbital space. Mouth small, inferior, overhung by the bluntly decurved but not very broad muzzle; barbels quite long and distinct, 13 scales in front of the dorsal. Fins well developed; the first rays of the dorsal about twice height of last. Pale olivaceous; sides with a plumbeous silvery band, in some specimens forming a stripe through eye and snout, and a dark spot at base of caudal; cheeks silvery; snout in males red, with numerous dust-like tubercles; specimens in high spring coloration have the fins largely red. Length 3 inches. Basin of the Altamaha, Georgia; common. (*ruber*, red; *frons*, forehead.)

*Nocomis rubrifrons*, Jordan, Ann. Lyc. Nat. Hist. N. Y., 1876, 330, Ocmulgee River. Flat Shoals, Georgia. (Type, Nos. 17863 & 20146. Coll. Jordan.)
*Ceratichthys rubrifrons*, Jordan & Gilbert, Synopsis, 214, 1883.

### 533. HYBOPSIS AMBLOPS (Rafinesque).

(Silver Chub.)

Head 4; depth 5. D. 8; A. 7; scales 5–38–4; teeth 1, 4–4, 1. Body rather slender, somewhat heavy anteriorly, not much compressed. Head large, flattened and broad above; eye very large, longer than snout and longer than interorbital space, 3 in head. Mouth horizontal, subinferior, and rather small; muzzle bluntly decurved; upper lip below level of orbit; maxillary not reaching line of front of orbit; barbel evident. Fins moderate. Lateral line somewhat decurved; sixteen scales before dorsal. Color translucent greenish; scales somewhat dark-edged; sides with a bright silvery band which overlies dark pigment, so that sometimes a plumbeous or even blackish band appears; a dark band through eye around snout; males without tubercles or red coloration. Length 2 to 3 inches. New York to Iowa, and southward to Alabama. Very common in the Ohio Valley and the Tennessee Valley. Southern specimens, (var. *winchelli*), have the head narrower and the barbel rather shorter. (ἀμβλύς, blunt; ὤψ, face.)

*Rutilus amblops*, Rafinesque, Ichth. Oh., 51, 1820, Ohio River, at the Falls.
*Hybopsis gracilis*, Agassiz, Amer. Journ. Sci. Arts, 1854, 358, Huntsville, Alabama.
*Hybopsis winchelli*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 211, Black Warrior River, Alabama. (Coll. Winchell.)
*Ceratichthys hyalinus*, Cope, Journ. Ac. Nat. Sci. Phila., 1868, 226, tributary Holston River, (Type, No. 14995. Coll. Cope.) Günther, Cat., vii, 179, 1868.
*Nocomis amblops*, Jordan, Ann. Lyc. Nat. Hist. N. Y., 1876, 328.
*Ceratichthys amblops*, Jordan & Gilbert, Synopsis, 214, 1883.

### 534. HYBOPSIS STORERIANUS (Kirtland).

Head 4⅓; depth 4; eye 3; snout 3. D. 8; A. 8; scales 5–42–4. Body elongate, compressed, the back somewhat elevated from the occiput to base of dorsal, thence rapidly declined to the long and slender caudal peduncle. Head short, compressed, the cheeks nearly vertical. Interorbital space rather broad and flat, somewhat grooved. Eye very large, circular, high up, about 3 in head, nearly midway of length of head, its diameter about equal to length of snout, scarcely greater than width of interorbital space. Preorbital bone large, oblong, conspicuous, and silvery. Mouth rather small, horizontal, the lower jaw included; edge of premaxillary below level of eye; maxillary not reaching to front of orbit. Barbel conspicuous. Snout boldly and abruptly decurved, much as in *H. amblops*, the tip of the snout thickened, forming a sort of pad. Lateral line somewhat decurved. Rows of scales along back converging behind dorsal, where the upper series run out, as in *Notropis cornutus*. Fins rather higher and more falcate than in *H. kentuckiensis*; dorsal fin inserted well forward, over ventrals; pectoral fins pointed, not reaching ventrals; ventrals not reaching vent; caudal long, deeply forked. Teeth usually 1, 4–4, 0, hooked, without grinding surface. Translucent greenish above; sides and below brilliantly silvery; cheeks and opercles with a bright silvery luster; fins plain; a slight plumbeous lateral shade; no caudal spot; no red. Length 5 to 10 inches. Lake Erie to Nebraska and eastern Wyoming, Tennessee, and Arkansas; abundant in the larger streams, especially in Iowa. (Named for David Humphreys Storer, author of the excellent History of the Fishes of Massachusetts, and of the first "Synopsis of the Fishes of North America," (1846).

*Rutilus storerianus*, Kirtland, Proc. Bost. Soc. Nat. Hist., i, 1842, 71, Lake Erie.
*Gobio vernalis*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 189, Arkansas River, Fort Smith. (Coll. Shumard.)
*Ceratichthys lucens*, Jordan, Proc. U. S. Nat. Mus., 1879, 238, Falls of Ohio River, New Albany, Indiana; (Type, No. 23462. Coll. Jordan.), and Jordan & Gilbert, Synopsis, 213, 1883.
*Hybopsis storerianus*, Jordan & Meek, Proc. U. S. Nat. Mus., 1885, 6.

## Subgenus YURIRIA, Jordan & Evermann.

### 535. HYBOPSIS ALTUS (Jordan).

(Pesca Blanca.)

Head 3⅔ to 4¼; depth 3¾ to 4⅕. D. 8; A. 8; scales 9–45–3, 16 to 19 before dorsal; teeth 4–4, with broad grinding surface and slight hook. Body rather elongate, compressed, the back elevated; head rather long and low, the anterior profile gently curved, a little depressed over the eye; snout long, rather blunt at tip, 3½ in head; eye rather small, 5½ in head; mouth rather large, oblique, the lower jaw slightly included, the premaxillary on level of pupil; maxillary reaching about to eye, 3⅗ in head; a very small, but evident barbel at tip, (overlooked in the original description); preorbital broad; suborbital narrow; opercle broad, silvery. Lateral line complete, decurved anteriorly. Scales large, not closely imbricated, those on breast and back little reduced. Dorsal high, pointed, the anterior rays much longer than posterior, the first over ventrals and over 17th scale of lateral line, 1⅓ in head; caudal well forked; anal short, pointed; pectorals pointed, reaching ventrals. Color pale olivaceous above; sides silvery; fins plain; sexes alike. Length 15 inches. Lakes and streams of Guanajuato, tributary to Rio Lerma, Pacific drainage. One of the largest minnows; a food-fish of some local importance; here described from specimens obtained by Mr. Woolman in Rio de Lerma, at Salamanca, in Guanajuato. (*altus*, high, from the form of the body.)

*Hudsonius altus*, Jordan, Proc. U. S. Nat. Mus., 1879, 301, Lake Tupataro, Guanajuato. (Type, No. 23125–9. Coll. Dugès.)
*Cliola alta*, Jordan & Gilbert, Synopsis, 163, 1883.
*Hybopsis altus*, Woolman, Bull. U. S. Fish Comm., xiv, 1894, 61.

### Subgenus NOCOMIS, Girard.

### 536. HYBOPSIS KENTUCKIENSIS (Rafinesque).

(Horny Head; River Chub; Jerker; Indian Chub.)

Head 4; depth 4¼. D. 8; A. 7; scales 6–41–4; teeth 1, 4–4, 1, or 1, 4–4, 0, sometimes 4–4. Body rather robust, little elevated, not much compressed. Head large, rather broadly rounded above; the snout conical, bluntish. Mouth rather large, subterminal, little oblique, the lower jaw somewhat the shorter; upper lip rather below level of eye; maxillary not reaching to front of eye. Eye small, median, high up. Barbel well developed. Suborbitals very narrow; preorbital large. Fins moderate; the dorsal rather posterior, slightly behind insertion of ventrals; caudal broad, little forked. Scales large, not crowded anteriorly, 18 rows in front of dorsal. Lateral line somewhat decurved. Color bluish-olive; sides with bright green and coppery reflections; a curved dusky bar behind opercle; scales above with dark borders; belly pale, but not silvery, rosy in spring males; fins all pale orange, without black spot; males in spring with a crimson spot on each side of head; adults with the top of the head swollen, forming a sort of crest, which is sometimes a third of an inch higher than level of the neck and is covered with large tubercles; young with a dark caudal spot. Length 6 to 9 inches. Pennsylvania to Wyoming and Alabama, on both sides of the Alleghanies; everywhere abundant in the larger streams, seldom ascending small brooks; one of the most widely diffused of our *Cyprinidæ*; western specimens usually have the teeth in two rows. Variable.

*Luxilus kentuckiensis*, Rafinesque, Ichth. Oh., 48, 1820, Ohio River.
*Catostomus melanotus*, Rafinesque, *l. c.*, 58, 1820, Ohio River, at the Falls.
*Semotilus biguttatus*, Kirtland, Bost. Journ. Nat. Hist., 1840, iii, 344, pl. v, fig. 1, Yellow Creek, a tributary of Mahoning River, Ohio.

*Nocomis nebrascensis*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 190, Sweetwater River, Nebraska. (Coll. Bowman.)
*Nocomis bellicus*, Girard, *l. c.*, 213, 1856, Black Warrior River. (Coll. Winchell.)
*Ceratichthys leptocephalus*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 213, Salem, North Carolina.
*Ceratichthys cyclotis*, Cope, Proc. Ac. Nat. Sci. Phila., 1864, 277, Grosse Isle, Waterford, Clinton River, and Bruce, Michigan; Günther, Cat., VII, 178, 1868.
*Ceratichthys micropogon*, Cope, Proc. Ac. Nat. Sci. Phila., 1864, 277, Conestoga River, Pennsylvania. (Coll. Jacob Stauffer.)
*Ceratichthys stigmaticus*, Cope, *l. c.*, 278, 1864, Michigan; Günther, Cat., VII, 179, 1868.
*Ceratichthys biguttatus*, Cope, Cypr. Penn., 366, 1866; Günther, Cat., VII, 178, 1868.
*Ceratichthys biguttatus* and *C. micropogon*, Jordan & Gilbert, Synopsis, 212, 1883.

## 131. COUESIUS, Jordan.

*Couesius*, Jordan, Bull. Hayden's Geol. Surv. Terr., IV, 785, 1878, (*milneri*).

Body elongate. Head normal, not depressed, the profile convex. Mouth terminal, normal, a well-developed barbel on the anterior side of maxillary, just above its tip. Teeth 2, 4–4, 2, hooked, without grinding surface. Scales rather small; lateral line continuous. Dorsal fin over or slightly behind ventrals; anal basis short. Size rather large. This genus is closely related to the section *Nocomis* under *Hybopsis*, from which it may be separated by the presence of 2 teeth in the lesser row, by the position of the barbel, and by the smaller scales. Its relations with *Semotilus* are equally close. The species are not well known. (Named for Dr. Elliott Coues, the most versatile and most inspiring writer on American ornithology, (1842——) who collected the type species in large numbers.)

*a.* Scales in a cross series from dorsal to lateral line about 17; 66 in the lateral line. SQUAMILENTUS, 537.
*aa.* Scales in a cross series from dorsal to lateral line 10 to 13.
  *b.* Scales in the lateral line 63 to 72.
    *c.* Free margin of dorsal fin concave, the anterior rays extending beyond the last rays when the fin is depressed. PLUMBEUS, 538.
    *cc.* Free margin of dorsal not concave, the tips of the anterior rays not reaching tips of last rays when the fin is depressed. DISSIMILIS, 539.
  *bb.* Scales in the lateral line 55 to 58.
    *d.* Scales before dorsal about 36. GREENI, 540.
    *dd.* Scales before dorsal about 27. ADUSTUS, 541.

### 537. COUESIUS SQUAMILENTUS (Cope).

Head $3\frac{4}{5}$; depth 5; eye $4\frac{2}{3}$. D. 8; A. 7; scales 17–66–14; teeth 2, 4–4, 1. Form stout, the profile nearly plane; muzzle not prominent. Mouth horizontal, the maxillary not reaching orbit; eye rather small, shorter than snout. Isthmus wide. Barbel quite small. Dorsal fin slightly in advance of ventrals, behind middle of body. Scales quite small. Olivaceous above; sides silvery; a lateral band of dark punctulations; fins plain. Henry's Fork of Green River in southwestern Wyoming. (Cope.) Perhaps not distinct from *C. dissimilis*, but the scales in transverse series said to be much more numerous. (*squamilentus*, small-scaled.)

*Ceratichthys squamilentus*, Cope, Hayden's Geol. Surv. Wyom., 1870, (1871), 442, Henry Fork of Green River, Wyoming, Colorado basin.
*Couesius squamilentus*, Jordan & Gilbert, Synopsis, 218, 1883.

### 538. COUESIUS PLUMBEUS (Agassiz).

Head $4\frac{1}{2}$; depth $4\frac{1}{2}$; eye 4. D. 8; A. 8; scales 11–60 to 70–7; teeth 2, 4–4, 2. Form of *Semotilus atromaculatus*, but more elongate and less compressed.

Head flattish above, the snout broad, somewhat projecting over the large, oblique mouth; maxillary reaching front of eye. Barbel evident. Eye large, as long as snout, 1½ in interorbital space. Scales small, crowded forwards, those on the back smaller. Dorsal beginning over last ray of ventrals. Height of dorsal fin 1 to 1⅛ in head; free margin of the fin concave, the anterior rays produced and extending beyond the others when the fin is depressed; longest anal ray 1⅕ to 1⅖ in head, its form similar to that of dorsal. Dusky above; sides somewhat silvery; an obscure dusky band through eye around snout; fins plain. Length 6 inches. Streams and lakes, from Lake Superior east to the Adirondack region and New Brunswick; not very common, except northward. (*plumbeus*, lead-colored.)

*Gobio plumbeus*, Agassiz, Lake Superior, 366, 1856, Lake Superior. (Coll. Agassiz.)

*Ceratichthys prosthemius*, Cope, Cypr. Penn., 365, 1866, Montreal River, Keweenaw Point, Lake Superior. (Coll. Dr. J. H. Slack.)

*Nocomis milneri*, Jordan, Bull. U. S. Nat. Mus., x, 64, 1877, Lake Superior. (Type, No. 20332. Coll. Milner.)

*Ceratichthys plumbeus*, Günther, Cat., vii, 176, 1868.

*Couesius dissimilis*, Jordan & Gilbert, Synopsis, 218, 1883, in part.

*Couesius prosthemius*, Jordan & Gilbert, Synopsis, 219, 1883.

### 539. COUESIUS DISSIMILIS (Girard).

Head 4⅓ to 4½; depth 4 to 5; eye 4 to 5 in head; snout 3 to 4. D. 8; A. 8; scales 12–68–8, varying from 64 to 72. Very close to *C. plumbeus*, the only important difference being in the form of the dorsal fin. Height of dorsal fin 1⅓ to 1½ in head; free margin of fin nearly straight, the anterior rays little if at all produced; when depressed barely reaching end of other rays; longest anal ray 1⅔ in head, the free margin of fin straight, the first rays where depressed not reaching beyond others. Upper Missouri and Black Hills region; generally common; probably a variety of *C. plumbeus*. (*dissimilis*, dissimilar, to *Semotilus atromaculatus*.)

*Leucosomus dissimilis*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 189, Milk River and Little Muddy River, Montana. (Type, No. 158. Coll. Suckley.)

### 540. COUESIUS GREENI, Jordan.

Head 4⅒; depth 4⅒; snout 3¾. D. 8; A. 8; scales 10–57–7; teeth 2, 4–4, 2. Body robust, the back convex before the dorsal, profile of head straight and rather steep, space between eyes broad and flattish, 3¼ in head. Snout bluntish, but rather long; premaxillary just above level of lower part of pupil; maxillary reaching almost to orbit, 3¾ in head; barbel well developed, not quite at end of maxillary; its length considerably less than that of pupil. Mouth moderately oblique, the lower jaw slightly included. Dorsal fin inserted behind base of ventrals and behind middle of body, at a point midway between preopercle and base of caudal, the fin of moderate height. Pectoral shortish, 1½ in head, ventrals nearly 2. Caudal well forked, the lobes equal; scales larger than in most related species, scarcely reduced forward and but little smaller on the back than on the sides; 36 scales in front of the dorsal. Color dark olive above, the sides reddish silvery; slight traces of a lateral band, a dark streak below the eye, undulating and extending from side of upper jaw to opercle. Lining of shoulder girdle dusky; fins without definite marking, the upper somewhat dusky. Length 6 inches. Stuart Lake, headwaters of Fraser River, British Columbia, and Lake Pend d'Oreille, Idaho. (Named for its discoverer, Ashdown H. Green, of Victoria.)

*Couesius greeni*, JORDAN, Proc. U. S. Nat. Mus., 1893, 313, Stuart's Lake, British Columbia. (Type, No. 44454.) GILBERT & EVERMANN, Investigations in Columbia River Basin, 44, 1894.

### 541. COUESIUS ADUSTUS, Woolman.

Head 4¼; depth 4⅔; eye moderate, 3⅔ to 4; snout 3⅓ to 3½. D. 8; A. 7; scales 13–58–8, 27 before dorsal; teeth 2, 4–4, 2. Body moderately elongate, compressed, the back a little elevated, the anterior profile rather convex. Snout rather long, slightly pointed; mouth low, terminal, oblique, the jaws subequal, the maxillary opposite posterior nostril; barbel evident in young, inconspicuous in adult, its position not quite terminal. Interorbital space broad, flattish; eye moderate; preorbital broad. Scales small, those before dorsal and on belly smallest; lateral line decurved. Dorsal inserted over or a little behind ventrals, the latter reaching the vent. Olivaceous, dusky above; sides silvery, a narrow plumbeous lateral band from snout to caudal, ending in a small black caudal spot which is obsolete in adult; fins all plain. Length 4 inches. Rio de los Conchos, Chihuahua; three specimens known. The smallest of these is deeper in body, more silvery, and with the barbel more conspicuous. (*adustus*, scorched.)

*Couesius adustus*, WOOLMAN, Bull. U. S. Fish Comm., XIV, 1894, 57, May 3, 1894, Rio de los Conchos, Chihuahua. (Coll. Woolman & Cox.)

## 132. PLATYGOBIO, Gill.

*Platygobio*, GILL, Trans. Amer. Phil. Soc. Phila., v, 12, 178, 1863, (*communis*).

Body rather elongate, somewhat compressed. Head rather short, more or less broad or depressed above; mouth normal, rather large, subterminal, with a well-developed barbel at its angle, at the extremity of the maxillary. Scales large. Lateral line continuous. Dorsal inserted anteriorly, rather in front of ventrals. Teeth 2, 4–4, 2, with rather narrow grinding surface. Size large; males without nuptial pigments or bright colors. (πλατύς, broad; *Gobio*, a gudgeon.)

*a.* Anterior profile nowhere concave, the head not specially depressed above; eye moderate, 4⅔ in head. PHYSIGNATHUS, 542.
*aa.* Anterior profile more or less concave above the depressed and flattened head.
  *b.* Eye small, 4 to 6 in head in adult; snout not tuberculate in males, so far as known; size large. GRACILIS, 543.
  *bb.* Eye large, 3¾ in head; males with the snout tuberculate; size small. PALLIDUS, 544.

### 542. PLATYGOBIO PHYSIGNATHUS (Cope).

Head 4⅔; depth 4⅔; eye 4⅔ in head, 1½ in snout, which is 3 in head. D. 8; A. 8, scales 6–48–5, 20 before dorsal; teeth 2, 4–4, 2, with distinct grinding surface. Body slender, the caudal peduncle stout. Head shorter, narrower, blunter, and less depressed than in *P. gracilis*. Dorsal outline little arched, the profile descending steeply to the lip, nearly even and nowhere concave. Lower jaw included, maxillary reaching anterior border of orbit. Barbels well developed. Dorsal fin inserted in front of ventrals. Olivaceous above, white below; a plumbeous lateral band; fins plain. Length 6 inches. Upper waters of Arkansas River; very abundant in the channels, the most common fish at Pueblo, Colorado. (*φυσάω*, to thicken; *γνάθος*, jaw.)

*Ceratichthys physignathus*, Cope, Wheeler Surv., Zoöl., v, 651, 1875, (1876), Arkansas River, Pueblo, Colorado. (Coll. Aiken.)

*Couesius physignathus*, Jordan & Gilbert, Synopsis, 219, 1883; Jordan, Bull. U. S. Fish Comm., ix, 1889, 17.

### 543. PLATYGOBIO GRACILIS (Richardson).

(Flat-headed Chub.)

Head 4¼; depth 4¾; eye 6 in adult. D. 8; A. 8; scales 6–50–5; teeth 2, 4–4, 2. Body rather elongate, somewhat compressed, little elevated. Head small and short, its upper surface very broad and depressed, the interorbital width being nearly half length of head; region behind nape gibbous, so that the anterior profile is more or less concave. Mouth rather large, slightly oblique, the upper lip on level of lower part of eye; maxillary reaching front of eye; upper jaw very protractile, lower jaw included. Eye small, rather high up and anterior. Fins rather large; dorsal in advance of middle of body; pectoral falcate, its upper rays elongate; caudal peduncle rather stout. Scales large and silvery; lateral line decurved; 23 scales in front of dorsal. Snout not tuberculate in males, so far as known. Coloration pale; back olive, sides and below silvery; head mostly white; fins pale; no dark lateral band or caudal spot. Length 12 inches. East slope of the Rocky Mountains, from the Missouri and Yellowstone rivers to the Saskatchewan; abundant in river channels as far south as Kansas City, not ascending to springs. (*gracilis*, slender.)

*Cyprinus* (*Leuciscus*) *gracilis*, Richardson, Fauna Bor. Amer., Fishes, 120, 1836, Saskatchewan River, at Carleton House.

*Pogonichthys communis*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 188, and Pac. R. R. Surv., x, 247, 1858, Fort Pierre, Fort Union, Milk River, Yellowstone River, Sweetwater River. (Type, No. 189, etc. Coll. Suckley.)

*Pogonichthys* (*Platygobio*) *gulonellus*, Cope, Proc. Ac. Nat. Sci. Phila., 1864, 277, near Bridger's Pass; "anal rays 9; scales 48." (Coll. Hammond.)

*Leuciscus gracilis*, Günther, Cat., vii, 240, 1868.

*Leucosomus communis* and *gulonellus*, Günther, Cat., vii, 267, 268, 1868.

*Platygobio communis*, Gill, Captain Simpson's Expl. Utah, 408, 1876.

*Platygobio gracilis*, Jordan & Gilbert, Synopsis, 220, 1883.

### 544. PLATYGOBIO PALLIDUS, Forbes.

Head 4; depth 4⅔; eye 3¾, 2 in interorbital width; snout 3¾. D. 8; A. 8; scales 6–55–5; teeth 2, 4–4, 2, hooked and with masticatory surface. Head flat above, the snout overhanging the mouth, which is large and wide, with a maxillary barbel about one-third as long as eye. Mandible reaching vertical through middle of iris. Scales with 22 rows before dorsal, where they are much smaller than elsewhere. Lateral line straight, except for a few scales in front. Pectoral fins large and pointed, reaching ventrals, the latter to vent; front of dorsal a trifle before ventrals and a little nearer snout than caudal. Color plain, with a plumbeous luster along sides, and traces of a dusky lateral stripe behind dorsal. Length 2½ inches. (Forbes.) One specimen from the Ohio River at Cairo, probably adult, as the snout is tuberculate. A doubtful species, perhaps the young of *P. gracilis*. (*pallidus*, pale.)

*Platygobio pallidus*, FORBES, MS., JORDAN & GILBERT, Synopsis, 220, 1883, Ohio River, at Cairo, Illinois. (Coll. Forbes.)

## 133. EXOGLOSSUM (Rafinesque).

*Exoglossum*, RAFINESQUE, Journ. Ac. Nat. Sci. Phila., I, 1818, 420, (*lesueurianum*).
*Maxillingua*, RAFINESQUE, *l. c.*, 1818, 421, (*maxillingua*).

Body moderately elongate, little compressed. Mouth peculiar, the mandible being contracted and incurved, its outline strongly 3-lobed; this appearance is due to the fact that the dentary bones lie close together, parallel, and are united throughout their length, instead of forming a broad arch, as in all other Cyprinoid fishes; lower lip represented by a broad, fleshy lobe on each side of the mandible. Upper jaw not protractile; upper lip thick, somewhat plicate. Pharyngeal bones small, the tooth hooked, without grinding surface, 1, 4–4, 1. Scales moderate. Lateral line complete. Fins without spines. Dorsal slightly behind ventrals. Anal basis short. Isthmus broad. Gill rakers weak. Pseudobranchiæ present. Air bladder normal. Alimentary canal short; peritoneum white. Size rather large. Sexual changes not marked, the males with some black pigment. One of the most strongly marked genera of *Cyprinidæ*, with a single species. (ἔξω, outside; γλῶσσα, tongue.)

### 545. EXOGLOSSUM MAXILLINGUA (Le Sueur).

(CUT-LIPS; NIGGER CHUB; NIGGER DICK.)

Head 4; depth 4½. D. 8; A. 7; scales 8–53–5; teeth 1, 4–4, 1. Body rather stout, little compressed. Head large, broad and flattish above, with tumid cheeks. Mouth moderate, slightly oblique, the end of maxillary not reaching line of orbit. Upper jaw longer than lower. Scales rather crowded anteriorly, those in front of dorsal small. Color olivaceous, smoky or dark above; a blackish bar behind opercle, and a dusky shade at root of caudal in young: fins unmarked. Length 6 inches. Lake Ontario, St. Lawrence River, Lake Champlain, Hudson River, and Cayuga Lake, and southward to Virginia; abundant in the basins of the Susquehanna, Hudson, Potomac, James, Roanoke, and Kanawha, but not widely distributed. One of the most singular of the *Cyprinidæ*, distinguished at sight by its 3-lobed lower jaw. (*maxilla*, jaw; *lingua*, tongue.)

*Cyprinus maxillingua*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., I, 1817, 85, Pipe Creek, Maryland.

*Exoglossum annulatum*, RAFINESQUE, Journ. Ac. Nat. Sci. Phila., I, 1818, 421, Hudson River.

*Exoglossum nigrescens*, RAFINESQUE, *l. c.*, 1818, 421, Lake Champlain.

*Exoglossum vittatum*, RAFINESQUE, *l. c.*, 1818, 421, Hudson River.

*Exoglossum lesueurianum*, RAFINESQUE, *l. c.*, 1818, 421, (after Le Sueur).

*Exoglossom maxillingua*, GÜNTHER, Cat., VII, 188, 1868; COPE, Cypr. Penn., 360, 1866; JORDAN & GILBERT, Synopsis, 160, 1883.

## 134. LEPIDOMEDA, Cope.

*Lepidomeda*, Cope, Proc. Amer. Phil. Soc. Phila., 1874, 131, (*vittata*).

Body elongate. Mouth terminal, without barbels. Teeth 2, 4–4, 2, hooked, without grinding surface. Scales small; lateral line complete. Dorsal fin with a strong spine, composed of two, the posterior received into a longitudinal groove of the anterior. Inner border of the ventral fins adherent to the body. Dorsal fin inserted behind the ventrals. Anal basis short. Size small. Extraordinary little fishes of the desert region of Arizona. (λεπίς, scale; *Meda.*)

*a.* Eye 3¾ in head; depth 4¼ in length. VITTATA, 546.
*aa.* Eye large, 3¼ in head; depth 5 in length. JARROVII, 547.

### 546. LEPIDOMEDA VITTATA, Cope.

Head 3¾; depth 4¼; eye 3¾. D. II, 7; A. 9; teeth 2, 4–4, 2. Body rather stout. Head wide and flat above, slightly depressed behind the eyes. Muzzle obtuse, not prominent. Mouth terminal, oblique. Scales small, covering the whole body except space behind pectorals; 26 series above lateral line and 56 in front of dorsal. Preorbital bone trapezoidal. Second dorsal spine as long as the first and wider. Dorsal rays somewhat enlarged and ossified. Pectorals scarcely enlarged. Color silvery; a lead-colored lateral band and a black dorsal band. Length 3½ inches. Known only from the Colorado Chiquito River, Arizona, and from Pahranagat Valley, Nevada. (*vittatus*, striped.)

*Lepidomeda vittata*, Cope, Proc. Amer. Phil. Soc. Phila., 1874, 131, Rio Colorado Chiquito, Arizona; (Type, No. 15785. Coll. Henshaw;) and Zoöl. Wheeler Surv., v, 642, pl. xxvi, figs. 2, 2a, 1875, (1876); Jordan & Gilbert, Synopsis, 251, 1883, (1876); Gilbert, Fishes of Death Valley Expedition, 231, 1893.

### 547. LEPIDOMEDA JARROVII, Cope.

Head 4; depth 5; eye 3¼. D. II, 7; A. 9; teeth 2, 4–4, 2. Body more elongate. Mouth nearly horizontal, lower jaw somewhat projecting. Eye larger than in *L. vittata*, maxillary reaching its anterior border. Spines slender. Scales very small and difficult to detect, 51 series before dorsal fin. Olivaceous; a median black vertebral band; sides silvery; bases of ventral fins red. Length 3 inches. Colorado Chiquito River, Arizona, (Cope), also in southern Nevada, in springs in the desert, (Gilbert). (Named for Dr. Henry C. Yarrow.)

*Lepidomeda jarrovii*, Cope, Proc. Am. Philos. Soc. Phila., 1874, 133, Rio Colorado Chiquito, Arizona; (Type, No. 15786. Coll. Henshaw;) and Zoöl. Wheeler Surv., v, 643, pl. xxvi, figs. 1, 1a, 1875, (1876); Jordan & Gilbert, Synopsis, 251, 1883.

## 135. MEDA, Girard.

*Meda*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 191, (*fulgida*).

Body elongate. Mouth terminal, normal; no barbels. Teeth 2, 5–5, 2, hooked, without grinding surface. Body entirely scaleless. Fins as in *Lepidomeda*. Size small. Gila region. (*Meda*, a classical feminine name, of no evident application to these singular fishes.)

### 548. MEDA FULGIDA, Girard.

D. II, 7; A. 8; teeth 2, 5–5, 2. Body slender, elongate, compressed. Head elongate, subconical, the snout rounded. Mouth large, subterminal, slightly oblique, the lower jaw included; maxillary extending to below orbit. Second dorsal spine highest; dorsal behind ventrals. Coloration silvery. Closely allied to *Plagopterus argentissimus*, but with the eye a little larger, the snout shorter, the lower jaw more prominent. Rio Gila. (*fulgidus*, shining.)

*Meda fulgida*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 191, Rio San Pedro, Arizona. (Type, No. 154. Coll. Clark.) GÜNTHER, Cat., VII, 263, 1868. JORDAN & GILBERT, Synopsis, 251, 1883.

## 136. PLAGOPTERUS, Cope.

*Plagopterus*, COPE, Proc. Amer. Phil. Soc. Phila., 1874, 301, (*argentissimus*).

Body slender. Mouth terminal; a barbel at the extremity of the maxillary. Teeth 2, 5–4, 2, hooked, without grinding surface. Body entirely scaleless. Fins as in *Meda* and *Lepidomeda*. Size small. (πλαγή, wound; πτερόν, fin; in allusion to the armature of the dorsal fin.)

### 549. PLAGOPTERUS ARGENTISSIMUS, Cope.

Head 4; depth 6; eye 4⅕. D. II, 7; A. 10; teeth 2, 5–4, 2. Body slender. Head rather broad, the muzzle slightly depressed, overhanging the rather small, horizontal mouth. Lips thin, the maxilliary reaching front of eye. Eye moderate. Dorsal fin entirely behind ventrals, the first spine curved, longer than the second; soft rays of dorsal thickened and ossified at base; fifth ray of ventral bound to the abdomen by a membrane for nearly its whole length; pectoral rays osseous at base. Lateral line complete, slightly deflexed. Color clear silvery; back dusky, with minute black dots. Length 2½ inches. Colorado Basin in western Colorado, (Cope;) Fort Yuma, (Gilbert.) (*argentissimus*, most silvery.)

*Plagopterus argentissimus*, COPE, Proc. Amer. Phil. Soc. Phila., 1874, 130, San Luis Valley, Colorado; (Type, No. 15776. Coll. G. C. Newberry;) and Zoöl. Wheeler Surv., v, 640, pl. XXVI, figs. 3, 3a, 1875, (1876); JORDAN & GILBERT, Synopsis, 252, 1883.

## Suborder HETEROGNATHI.

Brain case not produced between the orbits. Lower pharyngeals rarely modified into falciform structures bearing differentiated teeth. Jaws with or without teeth; no pseudobranchiæ. Adipose fin present or absent. Fins with soft rays only. Fresh water fishes of the tropics, constituting two families. They are really allied to the *Cyprinidæ* and to the other groups with modified anterior vertebræ, but in appearance they have many analogies with the *Salmonidæ*. (ἕτερος, different; γνάθος, jaw.)

### ANALYSIS OF FAMILIES OF HETEROGNATHI.

*a.* Supra-occipital confined to back of skull and with a very slight vertical crest. Adipose fin wanting. ERYTHRINIDÆ, XXXVIII.

*aa.* Supra-occipital partly superior and carinated by a procurrent crest. Adipose fin well developed. CHARACINIDÆ, XXXIX.

## Family XXXVIII. ERYTHRINIDÆ.

Heterognaths with the skull above truncated behind, and the supraoccipital confined to back of skull and carinated by a very slight vertical crest. (Gill.) Adipose fin none; gill openings wide, the membranes slightly united, free from the isthmus; nostrils close together; teeth in jaws well developed; pharyngeal teeth villiform; cheeks covered by the suborbitals; brain case inclosed above. Body elongate, belly rounded. Dorsal fin short, of 8 to 15 rays. Carnivorous species, with short intestines. Otherwise as in the *Characinidæ*. Fresh waters of South America. Genera 4. Species about 20, one of them reaching our limits.

*a.* Dorsal fin inserted in advance of anal, over ventrals; gape very wide, little oblique; both jaws with strong canines; maxillary with fine pectinate teeth; teeth on palatines; caudal rounded; lateral line developed.

*b.* Walls of air bladder normal; teeth all pointed; maxillary with a canine; palatine teeth with an outer series of enlarged teeth separated from the villiform teeth.

MACRODON, 137.

### 137. MACRODON, Müller.

(TRAHIRAS OR AIMARAS.)

*Macrodon*, MÜLLER, Archiv., 308, 1842, (*trahira = malabaricus*).

Adipose fin none. Body elongate, the belly rounded; gill openings wide, the membranes slightly united, free from the isthmus; nostrils close together. Mouth very large; snout pointed. Teeth well developed; an outer series of palatine teeth enlarged and separated from the villiform teeth; a detached patch of teeth in front of palatines; lower jaw with canines anteriorly and laterally; all the teeth pointed; maxillary with a canine anteriorly; dentary process joined to the dentary at the symphysis within the lateral canines and merging into the dentiferous ridge midway between symphysis and posterior angle of dentary; the pit formed behind the larger canine and the one behind the lateral canine filled with numerous short conical teeth which lie concealed in the muscles; a deep pit in the premaxillary for the reception of the larger dentary canine; supratemporal plate single. Two species; large, voracious fishes, especially abundant in the Amazon region. (*μακρός*, long; *ὀδούς*, tooth.)

*a.* Scales across back of tail from lateral line to lateral line eleven in number.

MICROLEPIS, 550.

#### 550. MACRODON MICROLEPIS, Günther.

D. 14; A. 11; lateral line 43 or 44; scales a little smaller than in *M. malabaricus*,* there being 11 in a row across the tail above, from the lateral line on one side to that on the other; sides mottled with light or dark brown. Panama to Ecuador, chiefly west of the Andes. Known from Rio Chagres and from Ecuador. (Eigenmann). (*μικρός*, small; *λεπίς*, scale.)

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* This species, *Macrodon malabricus*, is universally common throughout eastern South America, from Trinidad and Rio Magdalena to Rio de la Plata. Its scales are nine from lateral line to lateral line as above indicated. Its occurence north of the isthmus is not improbable.

Concerning the name of this species Professor Cope remarks: "Authors who think, with the American Ornithologists' Union, that scientific nomenclature may record error instead of truth, call this well-known South American species *Macrodon malabaricus*, because Bloch described it first under that name, under the mistaken idea that it was a native of India." In the judgment of the present writers, the law of priority by which the first unpreoccupied name is right, and all others wrong, a rule which tends to secure fixity of nomenclature, is more important than any rule leading toward truthfulness or purism in the name itself. On this ground, *Macrodon malabaricus* does not mean a *Macrodon* from Malabar. It simply designates that *Macrodon* of which the earliest unpreoccupied binominal specific name is *malabaricus*. The errors in meaning in specific names deceive nobody and rarely cause inconvenience.

*Macrodon microlepis*, GÜNTHER, Cat., v, 282, 1864, Western Ecuador; Chagres River, Guatemala; (Coll. Fraser.) EIGENMANN, Ann. N. Y. Ac. Sci , 1889, 102.

## Family XXXIX. CHARACINIDÆ.

### (THE CHARACINS.)

Heterognaths with the skull above more or less invaded by reentering valleys from behind, and the supra-occipital partly superior and carinated by a procurrent crest. (Gill). Body variously formed, covered with cycloid scales. Head naked. Margin of upper jaw formed mesially by the premaxillaries and laterally by the maxillaries; no barbels; premaxillaries not protractile. Teeth various, often incisor-like, often wanting. Branchiostegals usually 3. Gill membranes united to the isthmus or not; no pseudobranchiæ; gills 4, a slit behind the fourth; lower pharyngeals not truly falciform, but more or less curved, armed with small, sometimes villiform teeth. Adipose fin present or absent.* Pyloric cœca usually numerous. Air bladder transversely divided into two portions, and communicating with the organ of hearing by means of auditory ossicles, as in *Cyprinidæ*; anterior vertebræ coalesced and modified. A very large family of some 55 genera and 300 species, inhabiting the fresh waters of South America and Africa, where they take the place of the *Salmonidæ* and *Cyprinidæ* of the Northern Hemisphere. A single species reaches the United States. The few species enumerated below are but the overflow of the vast South American river fauna.

(*Characinidæ*, GÜNTHER, Cat., v, 278–380, 1864).

CURIMATINÆ:

*a*. Dentition imperfect.

  *b*. Teeth none; no gill rakers; belly trenchant or not, with a median series of scales not ending in spiniform processes; lateral line complete; mouth nearly horizontal; tongue adnate, short and thick. CURIMATA, 138.

*aa*. Teeth well developed in both jaws; dorsal fins short; gill openings wide, the membranes not attached to the isthmus; nostrils close together.

TETRAGONOPTERINÆ:

  *c*. Teeth compressed, notched or denticulated.

    *d*. Anal fin short, (10 to 12 rays); no lateral line; premaxillary teeth in one series. PIABUCINA, 139.

    *dd*. Anal fin more or less elongate; lateral line more or less developed.

      *e*. Belly in front of ventrals rounded; gill rakers slender.

        *f*. Premaxillary teeth in a double series; no conical teeth behind front teeth of lower jaw. TETRAGONOPTERUS, 140.

        *ff*. Premaxillary teeth in three or four series; a pair of conical teeth behind middle of the front series of teeth in lower jaw. BRYCON, 141.

      *ee*. Belly in front of ventrals compressed; no canines; ventral fins very small. GASTEROPELECUS, 142.

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*The adipose fin in *Characinidæ* is probably a survival from a remote ancestry which they share with Siluroid forms. In the *Salmonidæ*, it is doubtless also a survival, but notwithstanding the superficial resemblances in certain genera, (as *Curimatinæ* and *Coregoninæ*,) there is no evidence of any special relationship between the *Salmonidæ* and *Characinidæ*. They should not be placed in the same order; scarcely even in related orders. The adipose fin in *Percopsidæ* is probaby also an independent survival.

CHARACININÆ:

- *cc.* Teeth in premaxillary and mandible all conical; dorsal short; gill membranes free from isthmus.
  - *g.* Teeth on the palate none; anal fin long; body oblong or elevated.
    - *h.* Scales very small; jaws with external tooth-like processes; teeth in lower jaw uni-serial; in upper uniserial or irregularly biserial. RŒBOIDES, 143.
    - *hh.* Scales of moderate size; jaws without tooth-like processes; teeth in jaws uniserial. BRAMOCHARAX, 144.
  - *gg.* Teeth on the palate numerous, very small; head and body elongate; jaws very long; scales moderate, (43). LUCIOCHARAX, 145.

## 138. CURIMATA (Cuvier) Cloquet.

*Les Curimates*, CUVIER, Règne Animal, Ed. 1, II, 165, 1817, (*edentulus*).
*Curimata*, CLOQUET, Dict. Sci. Nat., XII, 240, 1818, (*edentulus*).
*Curimatus*, CUVIER & VALENCIENNES, XXII, 5, 1849, (*edentulus*).
*Curimatella*, EIGENMANN & EIGENMANN, Ann. N. Y. Ac. Sci., 1889, 7, (*lepidurus*).
*Semitapicis*, EIGENMANN & EIGENMANN, *l. c.*, 9, (*planirostris*).

No teeth anywhere; no gill-rakers. Body oblong or elevated, the outline of belly behind ventrals trenchant or not, always with a median series of scales which do not end in spinous processes. Lateral line complete. Tongue short and thick, adnate; no lips; margins of jaws trenchant. Dorsal fin nearly median; adipose fin present; anal moderate; ventrals below the dorsal. Amazon region; one species north to Panama. (*Curimata*, a Portuguese name used by Marcgrave, analogous to *Queriman* and *Curema*.)

### 551. CURIMATA MAGDALENÆ, Steindachner.

(SARDINA BLANCA.)

Head 3½; depth 4⅔; eye 3⅔ to 4⅙ in head. D. III, 9; A. III, 7; scales 6–37–6. Body not greatly compressed; caudal short, its lobes equal. A silvery lateral streak; no caudal spot and no spot on dorsal. Rio Magdalena; and Rio Mamoni, Panama. (Steindachner.)

*Curimatus magdalenæ*, STEINDACHNER, Fisch-fauna des Magdalenen-stromes, 34, 1878, Rio Magdalena; STEINDACHNER, Flussfische Südamerikas, I, 167, 1879.

## 139. PIABUCINA, Cuvier & Valenciennes.

*Piabucina*, CUVIER & VALENCIENNES, XXII, 161, 1849, (*erythrinoides*).

Body oblong, covered with moderate scales; belly rounded. No lateral line. Mouth moderate, the teeth rather small, tricuspid, those of the premaxillary in one series, those of the mandible in two; a few small teeth on the maxillary; palate toothless. Nostrils close together. Gill openings wide, the membranes free from the isthmus. Anal fin short; dorsal fin inserted just behind the ventrals. Adipose fin present. Species few. (Diminutive of *Piabuca*, a related genus, *Piabuca* being a Brazilian name.)

### 552. PIABUCINA PANAMENSIS, Gill.

Head 3½; depth 4. D. 10; A. 12; scales 30–8. Lower jaw slightly projecting; maxillary reaching middle of eye; eye 4 in head, longer than snout. Caudal emarginate; pectoral 4 in head, longer than ventrals.

Yellowish, with a dark lateral band extending from humeral spot to dark area at base of caudal; dorsal with a dark spot at base. Length $3\frac{1}{2}$ inches. Rio Frijoli, Atlantic slope of Isthmus of Panama. (Gill.)

*Piabucina panamensis*, GILL, Proc. Ac. Nat. Sci. Phila., 1876, 336, Rio Frijoli, Isthmus of Panama.

## 140. TETRAGONOPTERUS, Cuvier

### (SARDINAS BLANCAS.)

*Tetragonopterus*, CUVIER, Règne Animal, Ed. I, Vol. II, 166, 1817, (*argenteus*).
*Astyanax*, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 26, (*argentatus*).
*Pœcilurichthys*, GILL, Ann. Lyc. Nat. Hist. N. Y., 1858, 417, (*brevoorti*).
*Hemigrammus*, GILL, *l. c.*, 420, (*unilineatus*).
*Hemibrycon*, GÜNTHER, Cat., V, 330, 1864, (*polyodon*).

Body oblong or elevated, compressed, covered with moderate scales. Lateral line complete, (*Tetragonopterus*), or interrupted, (*Hemigrammus*). Belly rounded. Cleft of mouth medium. Anterior teeth strong, incisor-like; lateral teeth small; premaxillary and mandibular teeth equal in size, with a compressed, notched crown, the former in a double, the latter in a single series; maxillary with few or many teeth, not produced at tip. Nostrils of each side close together, separated by a valve only. Lower pharyngeals very slender, curved, approaching the form in *Cyprinidæ*, armed with a single series of slender, hooked teeth. Gill openings wide, the membranes free from the isthmus and from each other. Gill-rakers setiform. Dorsal fin midway of body, just behind ventrals; anal fin long. Fin rays in males in some species rough with small prickles. Species about 40, in all the warmer parts of America, one of them entering the United States. (τετράγωνος, four-angled; πτερόν, fin or wing; of no special application to this group, the original word used by Klein for his genus including *Chætodontids*, being *Tetragonoptrus* = "Τετραγωνοπτρός, *i. e.*, *quadratus aspectu*."

*a.* Lateral line complete; caudal fin with an oblong spot or band at base.
  *b.* Maxillary with few teeth or none along its edge.
    ASTYANAX:* (Astyanax, Αστυάναξ, a son of Hector.)
      *c.* Body ovate, the depth less than half the length; anal rays less than 40.
        *d.* Anal fin long, its rays 25 to 35.
          *e.* Depth $2\frac{3}{4}$ to $2\frac{2}{3}$ in length.
            ÆNEUS; RUTILUS; PANAMENSIS; MICROPHTHALMUS, 553 to 556.
          *ee.* Depth 3 to $3\frac{1}{4}$ in length.
            ŒRSTEDII; PETENENSIS; SCABRIPINNIS; HUMILIS, 557 to 560.
        *dd.* Anal fin moderate, its rays 20 to 23; humeral spot obsolete.
          *f.* Pectoral not reaching ventrals. BREVIMANUS, 561.
          *ff.* Pectoral reaching ventrals. MEXICANUS; ARGENTATUS, 562; 563.

### Subgenus ASTYANAX, Baird & Girard.

### 553. TETRAGONOPTERUS ÆNEUS, Günther.

Head 4; depth $2\frac{3}{4}$; eye $3\frac{1}{3}$ in head. D. 11; A. 26; V. 8; scales 7–35–6. Snout rather compressed; upper profile slightly concave; maxillary to front of eye; pectoral extending about to ventrals. Deep bronze color; a blackish caudal spot. (Günther.) Oaxaca, Mexico, and Rio Chagres, south to Brazil. (*æneus*, brassy.)

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*The species of this group needs a critical revision; some of them are of doubtful validity.

*Tetragonopterus æneus*, GÜNTHER, Proc. Zoöl. Soc. Lond., 1860, 319, Oaxaca, Mexico. (Coll. Sallé.) GÜNTHER, Cat., v, 326, 1864.

### 554. TETRAGONOPTERUS RUTILUS, Jenyns.

Head 4¼; depth 2⅔; eye 3½ in head. D. 11; A. 25 to 29; scales 6–37–6; upper profile little concave; maxillary reaching beyond front of ventrals; dorsal inserted just behind root of ventrals; pectorals reaching ventrals. Silvery, with an indistinct round dark spot behind shoulder; generally a band-like blackish spot on root of caudal; sometimes extending as a dark band to humeral spot; this band sometimes silvery; sometimes both band and spots absent. Mexico to Ecuador and Rio de la Plata, recorded as common in Central America. (Rio Chisoy, Rio Guacalate, Huamuchal, Cordova, etc.) (*Rutilus*, the roach, from *rutilus*, ruddy.)

*Tetragonopterus rutilus*, JENYNS, Zoöl. Beagle, Fish., 125, 1842, Rio Paraná. (Coll. Darwin). EIGENMANN, Proc. U. S. Nat. Mus., 1891, 52.

*Tetragonopterus tæniatus*, JENYNS, *l. c.*, 126, 1842, Rio Janeiro. (Coll. Darwin.)

*Tetragonopterus fuscoauratus*, CASTELNAU, Anim. Amér. Sud; Poiss., 66, pl. 33, fig. 2, 1855, Bahia.

*Tetragonopterus microstoma*, GÜNTHER, Cat., v, 323, 1864, Bahia. (Coll. Dr. Wucherer.)

*Tetragonopterus fasciatus*, GÜNTHER, Cat., v, 322, 1864, (not of CUVIER & VALENCIENNES).

### 555. TETRAGONOPTERUS PANAMENSIS, Günther.

Head 3⅞; depth 2¾; eye 3½ in head. D. 11; A. 28; scales 8–36–7. Similar to *T. rutilus*, but with more scales in a transverse series. Maxillary to front of eye; pectorals reaching a little beyond ventral base. Humeral and caudal spots present, united by a silvery band. (Günther.) Streams about Panama and Lake Yzabal; locally abundant.

*Tetragonopterus panamensis*, GÜNTHER, Cat., v, 324, 1864, Panama; Yzabal. (Coll. Godman & Salvin.)

*Tetragonopterus fischeri*, STEINDACHNER, Flussfische Südamerikas, I, 167, 1879, Mamoni River at Chepo, Colombia.

### 556. TETRAGONOPTERUS MICROPHTHALMUS, Günther.

Head 4¼; depth 2¾; eye about 4 in head. D. 11; A. 26 to 29; scales 7–36–8. Similar to *T. rutilus*, but the pectoral fin shorter, not reaching base of ventral. Maxillary reaching front of eye. Silvery, with a band-like spot at root of caudal; usually a silvery lateral band. Guatemala, (Lake Amatitlan), to Peru. (Günther.) (*μικρός*, small; *ὀφθαλμός*, eye.)

*Tetragonopterus microphthalmus*, GÜNTHER, Cat., v, 324, 1864, Lake Amatitlan; Rio Rimac, Peru. (Coll. Salvin.)

### 557. TETRAGONOPTERUS ŒRSTEDII, Kröyer.

Head 4; depth 3; eye 3 in head. D. 11; A. 29 to 31; scales 7–37–8. Mouth moderate, the maxillary about to front of eye; pectorals about to ventrals. Humeral and caudal spots present, connected by a faint silvery band. Rio San Juan, Nicaragua. (Lütken.) (Named for Professor A. S. Örsted of Copenhagen.)

*Tetragonopterus œrstedii*, KRÖYER, MS., LÜTKEN, Ict. Bidrag, III, 229, 1874, Rio San Juan, Nicaragua.

### 558. TETRAGONOPTERUS PETENENSIS, Günther.

Head 4; depth 3; eye 3½ in head. D. 11; A. 27; scales 7–37–7. Snout rather compressed; upper profile of head scarcely concave; maxillary to front of eye; dorsal inserted very slightly behind ventrals; pectorals not reaching ventrals. A silvery lateral band ending in an oblong black caudal spot. Lake Peten to western Ecuador, southeast to Argentine Republic. (Günther.)

*Tetragonopterus petenensis*, GÜNTHER, Cat., v, 326, 1864, Lake Peten. (Coll. Salvin.)

### 559. TETRAGONOPTERUS SCABRIPINNIS, Jenyns.

Head 3½; depth 3. D. 10; A. 25 to 28; scales 6–37–5. Upper profile scarcely concave; maxillary to beyond front of eye; pectoral extending beyond base of ventrals; humeral and caudal spots present, united by a silvery band. (Günther.) Jamapa, Mexico to Rio Janeiro. (*scaber*, rough; *pinna*, fin, the males having, as in *humilis*, *brevoortii*, etc., some of the fin rays roughened.)

*Tetragonopterus scabripinnis*, JENYNS, Zoöl. Beagle, Fishes, 125, 1842, Rio Janeiro. (Coll. Darwin.) GÜNTHER, Cat., v, 325, 1864.

### 560. TETRAGONOPTERUS HUMILIS, Günther.

Head 4⅛; depth 3¼; eye 3¾. D. 11; A. 27 to 31; V. 8; scales 7–36–7. Upper profile of head straight; maxillary to front of orbit; dorsal inserted behind ventrals; pectoral about to ventrals. Humeral and caudal spots more or less distinct; sides silvery; anal and ventrals with broad, red margins. Lake Amatitlan, Guatemala. (Günther.) (*humilis*, humble.)

*Tetragonopterus humilis*, GÜNTHER, Cat., v, 327, 1864, Lake Amatitlan, Guatemala. (Coll. Salvin.)

### 561. TETRAGONOPTERUS BREVIMANUS, Günther.

Head 3½; depth 3. D. 11; A. 22; scales 6–38–5. Snout short and thick; eye about 4 in head; upper profile of head not concave; maxillary extending to beyond front of eye. Dorsal inserted just behind ventrals; pectorals not reaching ventrals; caudal spot usual. Guatemala. (Günther.) (*brevis*, short; *manus*, hand.)

*Tetragonopterus brevimanus*, GÜNTHER, Cat., v, 325, 1864, Yzabal; Rio San Geronimo, Guatemala. (Coll. Godman & Salvin.)

### 562. TETRAGONOPTERUS MEXICANUS, Filippi.

Head 4; depth 2¾; eye 3½. D. 10 or 11; A. 21 to 23; scales 7–39–5. Snout bluntly rounded, projecting beyond the mouth; forehead transversely convex; maxillary to beyond front of eye; pectoral about to ventrals, as usual a little longest in males. Sides with the usual silvery band, ending in an oblong black caudal spot. Lakes about the City of Mexico. (Steindachner.)

*Tetragonopterus mexicanus*, FILIPPI, in Guérin's Rev. Mag. Zoöl., 1853, 166, City of Mexico; STEINDACHNER, Ichthyol. Notizen, VII, 11, 1868.

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### 563. TETRAGONOPTERUS ARGENTATUS (Baird & Girard).

Head 4; depth 3. D. 10; A. 21; scales 6–38–6. Body oblong, compressed. Snout blunt, lower jaw scarcely included. Pectorals reaching ventrals, the latter to vent. Olivaceous; a broad silvery band along sides; an oblong black spot at base of caudal, running up on the fin. Southern Texas and Mexico, (Rio Nueces, Rio Leona, and Rio Grande); also recorded, probably by error, from Arkansas by Le Sueur. Locally abundant; the northernmost representative of the family, perhaps identical with *T. mexicanus*, but apparently a little more slender, the lower jaw less included. Our specimens collected by Woolman and Cox in Chihuahua River. (*argentatus*, silvered.)

*Astyanax argentatus*, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., VII, 1854, 27, Rio Nueces; Rio Leona; Zoquito, Texas; Comanche Spring; Elm Creek; Turkey Creek; San Felipe; Devil River; Brownsville; Rio Sabinal. (Coll. Clark.) GIRARD, U. S. & Mex. Bound. Surv., Ichth., 74, 1859.

*Tetragonopterus argentatus*, GÜNTHER, Cat., V, 380, 1864; JORDAN & GILBERT, Synopsis, 255, 1883.

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NOTE.—In addition to these species more or less well defined, we add the following, too scantily characterized to receive a definite place in the system. They are noted by M. F. Bocourt, in Annales des Sciences Naturelles, 5ème Série, Zoölogie, T. IX, p. 62, 1868.

### NOTE SUR LES POISSONS DU GENRE TÉTRAGONOPTÈRE PROVENANT DU MEXIQUE ET DE GUATEMALA,

PAR M. BOCOURT.

La division générique des Poissons de la famille des Salmonides à laquelle Cuvier a réservé le nom de Tétragonoptère, employé précédemment par Artédi dans une acception plus large, compte de nombreux représentants dans les eaux douces de la région mexicaine et parmi les espèces que j'ai rencontrées pendant mon voyage dans cette partie de l'Amérique, il en est plusieurs qui me paraissent nouvelles. Je me propose d'en publier prochainement une description détaillée, accompagnée de figures, et en attendant, pour prendre date, j'en donnerai ici la liste.

*1. Espèces chez lesquelles la longueur de l'espace interorbitaire est égale au diamètre longitudinal de l'œil:

1. *Tetragonopterus cobanensis.*

Cette espèce est bien caractérisée: 1° par la longueur et l'épaisseur de la tête; 2° par la direction rectiligne du profil suscéphalique; 3° par les dimensions de la base de l'anale qui sont moindres que l'espace comprise entre les deux dorsales. Rivière de Coban.

2. *Tetragonopterus oaxacanensis.*

Cette espèce diffère de la précédente par la forme de la tête qui est plus courte et plus épaisse. Oaxaca.

3. *Tetragonopterus nitidus.*

Cette espèce ressemble au *T. argentatus* par le peu de longueur de la base de ses anales, mais elle s'en distingue nettement: 1° par la largeur de son interorbitaire; 2° par la forme et la structure de ses écailles, dont les stries radiées sont nombreuses, bien dessinées et traversées par des lignes concentriques non diagonales, comme dans l'espèce précédente. De Tasco.

*2. Espèces chez lesquelles la largeur de l'espace interorbitaire est plus grande que le diamètre de l'œil:

4. *Tetragonopterus fulgens.*

Cette espèce se distingue aussi du *T. nitidus* par les dimensions moindres de ses yeux et par la situation de la dorsale placée un peu plus en avant. Province de Cuernavaca.

5. *Tetragonopterus finitimus.*

Cette espèce, très-voisine du *T. macrophthalmus*, mais qui s'en distingue: 1° par la position plus reculée de la dorsale dont le premier rayon est environ au milieu du corps; 2° par les écailles plus fortement striées; 3° par la grandeur de ses yeux. Environs de Orizaba.

6. *Tetragonopterus belizianus.*

Espèce voisine du *T. panamensis*: elle se distingue par une plus grande élévation du corps; par la disposition et le nombre des stries des écailles (12 à 13) et par le système de coloration. Environs de Belize.

## 141. BRYCON, Müller & Troschel.

*Brycon*, Müller & Troschel, Horæ Ichthyologiæ, I, 15, 1845, (*falcatus*).
*Chalcinopsis*, Kner, Sitzungsber. Akad. Wiss. München, 1863, 226, (*striatulus*).
*Megalobrycon*, Günther, Proc. Zoöl. Soc. Lond., 1869, 423, (*cephalus*).

Dorsal inserted behind ventrals, in middle of length of body; anal fin long. Body oblong, covered with scales of uniform size; belly rounded before ventrals, compressed behind them. Mouth wide, the premaxillary with 3 or 4 series of tricuspid teeth; maxillary with small teeth; mandible with a series of strong tricuspid teeth and a pair of conical teeth in the middle, behind them. Nostrils close together, separated by a valve. Gill openings wide, the membranes slightly united, free from isthmus. Gill-rakers lanceolate. Species numerous, chiefly Brazilian. (*βρύκω*, to bite.)

Chalcinopsis, (*Chalcinus*, a related genus; ὄψις, appearance):
- *a.* Premaxillary teeth in four series.
  - *b.* Scales moderate, 48 to 55 in lateral line. dentex, 564.
  - *bb.* Scales small, 73 to 80 in lateral line. striatulus, 565.

### Subgenus CHALCINOPSIS, Kner.

### 564. BRYCON DENTEX, Günther.

Head 4½; depth 3¼. D. 11; A. 35; scales 9–48 to 55–7. Snout longer than eye in adult; maxillary not reaching to center of eye; caudal deeply forked; pectoral reaching about to ventrals. Silvery, some scales spotted or margined with black; humeral part of gill opening black; usually a black spot at base of caudal; anal usually black-edged. Yucatan to Ecuador. (Günther.) (*dentex*, large-toothed.)

*Brycon dentex*, Günther, Proc. Zoöl. Soc. London, 1860, 240, Esmeraldas, Ecuador. (Coll. Fraser.)
*Chalcinopsis dentex*, Günther, Cat., v, 337, 1864.

### 565. BRYCON STRIATULUS (Kner).

D. 11; A. 36 or 37; scales 13–73 to 80–9. Scales much smaller than in *B. dentex*; sides of body immaculate, or with rows of oblique brownish spots; caudal spot sometimes present. Rio Chagres and streams about Panama. (Kner.) (*striatulus*, narrowly streaked.)

*Chalcinopsis striatulus*, Kner, Sitzungsber. Akad. Wiss. München, 1863, 223, Panama; Günther, Cat., v, 337, 1864.
*Chalcinopsis chagresensis*, Kner, *l. c.*, 223, Rio Chagres; Günther, *l. c.*, 338, 1864.

## 142. GASTEROPELECUS (Gronow) Pallas.

*Gasteropelecus*, Gronow, Mus. Ichthyol., II, 7, 1763, (nonbinomial).
*Gasteropelecus*, Pallas, Spicilegia, 1769, VIII, 50, (*sternicla*).

Body strongly compressed, the thoracic region dilated into a semicircular disk; the belly compressed to a sharp edge; scales moderate; lateral line incomplete, descending backwards towards anal fin. Mouth moderate, with compressed tricuspid teeth in 1 or 2 series in premaxillary, in 1 series in lower jaw; maxillary with a few minute conical teeth; palate toothless; nostrils close together. Gill openings wide, the membranes free from isthmus; gill-rakers slender, lanceolate. Dorsal fin inserted behind middle of body, above anal; anal long; pectorals long; ventrals small or rudimentary. Species few, chiefly Brazilian. (*γαστήρ*, belly; *πελέκυς*, axe.)

#### 566. GASTEROPELECUS MACULATUS, Steindachner.

(PÈCHE-PÈCHE.)

Head 3⅔; depth 1⅔. D. 11; A. III, 33; P. 10; scales 31 or 32. Premaxillary teeth in two rows; upper jaw with three simple canines on each side; pectoral falcate, nearly half length of body; ventrals minute; dorsal small; caudal moderate; anal very long; lateral line not reaching anal. Length 3 inches. Silvery, many of the scales above with dark spots; a silver gray stripe from shoulder to caudal. Rio Mamoni, near Panama. (Steindachner.) (*maculatus*, spotted.)

*Gasteropelecus maculatus*, STEINDACHNER, Fluss-fische Südamerikas, 168, 1879, Rio Mamoni, at Chepo, Panama.

### 143. RŒBOIDES, Günther.

*Rœboides*, GÜNTHER, Cat., v, 347, 1864, (*microlepis*).

Body oblong or rather elevated, covered with very small scales; lateral line complete. Belly rounded in front of ventrals, which are close to pectorals; humerus dilated or produced in a process before pectorals. Mouth wide, with conical teeth in premaxillary, maxillary and mandible; those on mandible uniserial; those in upper jaw uniserial or irregularly biserial; front of jaws with short, conical, tooth-like processes directed forwards; palate toothless. Nostrils close together, separated by membrane only. Gill-openings wide, the membranes separate, not attached to the isthmus; gill-rakers slender, lanceolate. Dorsal fin short, nearly median, behind ventrals; anal long, beginning below or before dorsal. Adipose fin present. Species few. (*ῥαβοϊδής*, crooked-looking.)

#### 567. RŒBOIDES GUATEMALENSIS (Günther).

Head 4; depth 2¾; eye 3½ in head. D. 11; A. 51; scales 19–80–22. Vertebræ 12 + 22. Each jaw anteriorly with a short, conical, tooth-like process directed forward on each side; no canine teeth above, those below small and short; lower jaw shortest; maxillary reaching nearly to middle of eye. Back elevated, the upper profile forming an S-shaped curve. Humeral process ending in a point. Dorsal inserted above fifth or sixth anal ray; caudal deeply forked; ventral below middle of pectoral, which nearly reaches anal. Olivaceous, with a silvery lateral band. Rio Chagres, and streams of Guatemala. (Günther.)

*Anacyrtus guatemalensis*, GÜNTHER, Cat., v, 347, 1864, Rio Chagres; Huamuchal. (Coll. Salvin & Dow.)

### 144. BRAMOCHARAX, Gill.

*Bramocharax*, GILL, Proc. Ac. Nat. Sci. Phila., 1877, 189, (*bransfordi*).

Body elongate, fusiform, compressed, covered with moderate-sized scales; belly before ventrals rounded; lateral line decurved, complete.

Head moderate, with slender and pointed snout; suborbital bones well developed; nostrils separated by a membranous partition; mouth rather large, oblique, reaching to beyond front of eye; teeth in each jaw in 1 series, compressed and conical, some of the lower teeth enlarged near symphysis; teeth of maxillary extending along nearly its entire edge, small, compressed, and multicuspid; teeth on palate undescribed, probably wanting; gill openings broad, the membranes separate and free. Dorsal fin short, behind ventrals; anal moderate; pectorals moderate. One species, apparently allied to the South American genus, *Salminus*, but the teeth uniserial, not biserial. (*Brama*, bream; *Charax*, for Characin.)

### 568. BRAMOCHARAX BRANSFORDI, Gill.

Head 3⅔; depth 2¾; eye large, 4 in head. D. 11; A. II, 26; V. I, 8. Snout somewhat longer than eye, attenuated and projecting slightly beyond chin; maxillaries much decurved, reaching beyond middle of eye; Physiognomy of subgenus *Astyanax*, (*Tetragonopterus*). Scales and color undescribed. Lake Nicaragua. (Gill.) (Named for Dr. J. F. Bransford.)

*Bramocharax bransfordi*, GILL, Proc. Ac. Nat. Sci. Phila., 1877, 190, Lake Nicaragua.

## 145. LUCIOCHARAX, Steindachner.

*Luciocharax*, STEINDACHNER, Fisch-fauna des Magdalenen-stromes, 67, 1878, (*insculptus*).

Head and body elongate, the belly rounded; surface of head bony; snout produced, conical; jaws very long, each armed with 1 series of very small teeth with the points directed backward; maxillary short, with teeth; many small teeth on the palate. Gill membranes free and separate. Scales not very small; lateral line incomplete. Dorsal behind ventrals and behind middle of body; dorsal and anal extended backward. Intestinal canal short. One species. (*Lucius*, pike; *Charax*, used for Characin.)

### 569. LUCIOCHARAX INSCULPTUS, Steindachner.

Head 3; depth 6; eye 9 in head. D. II, 8; A. III, 9; P. 20; scales 44, 10 in transverse series, the lateral line on 20 to 24. Body elongate; all the bones of the head sculptured; snout long and narrow. Grayish, sides silvery, a black spot edged with pale at base of caudal. Length a foot. Rio Magdalena and Rio Mamoni, (near Panama). (Steindachner.) (*insculptus*, chiseled.)

*Luciocharax insculptus*, STEINDACHNER, Fisch-fauna des Magdalenen-stromes, 67, 1878, Rio Magdalena and Rio Mamoni.

## Suborder GYMNONOTI.

Body more or less elongate and eel-like, with many vertebræ. Shoulder girdle suspended from the skull; parietal bones distinct, largely in contact; pterotic normal; symplectic bone present; opercular bones complete; mouth with its upper edge formed chiefly by the premaxillaries; no præcoracoid or interclavicles; anterior vertebræ united, modified, and with the ossicula auditus, as in the *Nematognathi* and the other *Plectospondyli*. Superior pharyngeal bones simple. Dorsal fin wanting or reduced to an adipose strip. Vent near the head, the anal fin being exceedingly long. Scales small or wanting. Ribs well developed. Air bladder present, double. Stomach with a blind sac and pyloric cœca. Ovaries with oviducts. Fresh-water fishes from South America, about thirty species being known. The group is divisible into two families quite diverse from each other, the one containing the singular Electric Eel, (*Electrophorus electricus*), which Cope regards as intermediate between the eel-like Siluroids, (*Clariidæ*), and the Eels. In this group the maxillaries are rudimental and the form decidedly eel-like. The remaining species, constituting the suborder *Gymnonoti*, resemble the Characins rather than the Eels, and have no appreciable relationships to the latter. It seems to us unlikely that any of the Eels are descended from fishes like the *Gymnonoti*, with the anterior vertebræ modified. The eel-like form of *Electrophorus* is probably the result of independent skeletal degradation. (*Gymnotidæ*, Günther, Cat., VIII, 1–11, 1870.) (*γυμνός*, naked; *νῶτος*, back.)

## Family XL. GYMNOTIDÆ.

Body elongate, compressed, covered with rather small scales, the tail much produced and usually ending in a point. Mouth small, the teeth moderate, sometimes wanting, the margin of the upper jaw formed partly by the maxillaries. Dorsal fin absent or reduced to an adipose strip; caudal fin rudimentary or wanting; no ventrals. Vent close behind the head, the anal fin very long. Genera 6; species 30; abounding in the rivers of South America, with the *Characinidæ*, to which group they are probably most closely related. (Günther, Cat., VIII, 1–9, 1870.)

*a.* Tail ending in a point without fins; no trace of dorsal fin.
  *b.* Each jaw with a series of conical teeth. Giton, 146.
  *bb.* Each jaw with a patch or band of very small teeth; eyelid covering the eye, without free rim. Eigenmannia, 147.

## 146. GITON, Kaup.

*Carapus*, Cuvier, Règne Animal, Ed. I, 237, 1817, (in part; *macrourus*, *fasciatus*, etc.).

*Carapus*, Müller & Troschel, Horæ Ichthyol., III, 13, 1845, (restricted to *fasciatus*; not *Carapus*, Rafinesque).

*Giton*, Kaup in Duméril, Analyt. Ichth., 201, 1856, (*fasciatus*; no description.)

Snout of moderate length, depressed. A series of conical teeth in each jaw. Lower jaw projecting. Anterior nostrils wide, in the upper lip. No trace of caudal or dorsal fin. Vent below the gill opening. (*γείτων*, neighbor.)

### 570. GITON FASCIATUS (Pallas).

(Carapo.)

Eye very small; scales moderate. Anal beginning below point of pectoral; teeth $\frac{26\text{ to }40}{38\text{ to }56}$. Color dusky, the young with irregular dark crossbars, which break up into spots with age. Guatemala to Rio de la Plata; generally abundant, especially in South America; recorded from Rio Matagua and Grenada. (*fasciatus*, banded.)

*Carapo*, Marcgrave, Hist. Pisc. Bras., 170, 1648, Brazil.

*Gymnotus fasciatus*, Pallas, Spicilegia Zoöl., VII, 35, 1769, anal rays about 180, fresh waters of America.

*Gymnotus albus*, Pallas, *l. c.*, 36, 1769, Surinam.

*Gymnotus brachiurus*, Bloch, pl. 157, fig. 1, 1787.

*Gymnonotus carapo*, BLOCH, Naturg., pl. 157, fig. 2, 1787; BLOCH & SCHNEIDER, Ichth., 521, 1801, anal rays 193, fresh waters of America, (after *fasciatus*, Pallas).
*Gymnotus putaol*, LACÉPÈDE, Hist. Nat. Poiss., II, 176, 1801, Brazil.
*Carapus inæquilabiatus*, VALENCIENNES, in d'Orb. Voy. Amer. Merid. Poiss., pl. 14, 1839.
*Carapus fasciatus*, GÜNTHER, Cat., VIII, 9, 1870.

### 147. EIGENMANNIA, Jordan & Evermann, new generic name.

*Cryptops*, EIGENMANN, Ann. N. Y. Ac. Sci., VII, February, 1894, 625, (*humboldti*); preoccupied in WORMS.

This genus differs from *Gymnotus* or *Sternopygus*, only in not having the orbital rim free. No trace of dorsal or caudal. Mouth moderate, the jaws subequal, both with a patch or band of small villiform teeth; a patch of minute teeth on each side of palate; snout moderate; anterior nostrils on upper side of head; vent behind the orbit. Only one species in our waters. (Named for Dr. Carl H. Eigenmann, in recognition of his excellent work on the fresh-water fishes of South America.)

#### 571. EIGENMANNIA HUMBOLDTI (Steindachner).

(MACANA.)

Head 1⅝ in greatest depth; P. 18, its length 1⅝ in head. A. 24. Body strongly compressed, the snout pointed. Eye without free margin, its diameter 2 in snout, which is 3 in head. Mouth small, the jaws equal, the upper as long as eye. Anal beginning below upper ray of pectoral; vent under posterior edge of interopercle; scales largest near front of second half of body, along lateral line; scales on nape very small. Length 1½ feet. Rio Magdalena and Rio Mamoni, (near Panama). (Steindachner.) (Named for Alexander von Humboldt.)

*Sternopygus humboldti*, STEINDACHNER, Fisch-fauna des Magdalenen-Stromes, 55, 1878, Rio Magdalena.

We next append four orders of fishes which agree in the degradation of the skeleton and in the eel-like form of the body, this form being produced by the development of a great number of vertebræ, and the corresponding deterioration of the fins and their basal segments. These fishes are all probably descended from extinct soft-rayed fishes, but the line of descent is not yet traced. We put them in this place in the series because less interruption seems to be caused by doing so than would result from interpolating them elsewhere.

## Order O. SYMBRANCHIA.

Body eel-shaped; premaxillary, maxillary, and palatine bones well developed and distinct from each other, as in ordinary fishes. Shoulder girdle joined to the skull in typical species, (in one family, *Amphipnoidæ*, distinct from the skull as in the eels). No mesocoracoid; symplectic present or absent; scales minute or wanting; no paired fins; vertical fins rudimentary, reduced to folds of the skin; vent at a great distance from the head; gill openings confluent in a single slit; no air bladder; stomach without blind sac or pyloric cœca; ovaries with oviducts; skull solid, the bones firmly united; vertebræ numerous, the anterior unmodified. Eel-like fishes, widely distributed in warm seas and in fresh waters.

The species are few, but highly diversified in structure, constituting two suborders and four families. They are probably related to the *Apodes*, but this is not certain, and in the structure of the head they approach more nearly to the true fishes. They represent degraded rather than primitive types, and the line of their descent is as yet unknown. It is not even certain that the forms grouped in this order are closely related. Cope makes two orders of them, *Ichthyocephali*, (*Monopteridæ*), and *Holostomi*, (*Amphipnoidæ* of Gill, and *Symbranchidæ*). But Dr. Gill has shown that the *Symbranchidæ* belong rather with the *Monopteridæ*. (*Symbranchidæ*, Günther, Cat., VIII, 12–18, 1870.) (*ςύν*, together; *βράγχια*, gills.)

### Analysis of Families of Symbranchia.

*a.* Symplectic present.
  *b.* Shoulder girdle connected to the skull by a bony post-temporal; vent behind the middle of the body; vertebræ about 80 + 55; gills well developed; palatine teeth in a band; gills without peculiar modification. Symbranchidæ, XLI.

## Family XLI. SYMBRANCHIDÆ.

### (The Symbranchoid Eels.)

Body eel-shaped, naked, the abdomen very long, longer than the tail; shoulder girdle attached to the skull by a well-developed, bifurcate post-temporal; snout short; eyes small, anterior; teeth small; palatine teeth in a band; gills well developed; gill openings confluent in a narrow slit; 4 gill arches; no accessory breathing sac; gill membranes free from the isthmus. Fresh water fishes, 1 genus and 3 species known. (*Symbranchidæ*, genus. *Symbranchus*, Günther, Cat., VIII, 15–17, 1870.)

### 148 SYMBRANCHUS, Bloch.

*Symbranchus*, Bloch, Ichthyologia, IX, 87, 1795, (*marmoratus*).
*Unibranchapertura*, Lacépède, Hist. Nat. Poiss., v, 658, 1803, (*marmoratus*).
*Ophisternon*, McClelland, Calcutta Journ. Nat. Hist., v, 197, 1845, (*bengalensis*).
*Tetrabranchus*, Bleeker, Nat. Tyds. Ned. Ind., II, 69, 1862, (*microphthalmus*).

Characters of the genus included above. Three species known, two from India, and the following. (*ςύν*, together; *βράγχος*, gill.)

#### 572. SYMBRANCHUS MARMORATUS, Bloch.

Snout short, rounded or pointed; eyes small, rather close to the end of the snout. Gill opening narrow, not extending to the edge of the ventral surface, generally transverse, arched, frequently appearing as a longitudinal slit unless drawn out. Vertebræ 79 + 57. Color brownish, variously marbled, sometimes immaculate. Tropical America, in streams from the Amazon northward to southern Mexico and St. Lucia; generally abundant. Recorded northward from Vera Cruz, Trinidad, St. Lucia, Lake Peten, Huamuchal, Rio Chisoy, etc.

*Symbranchus marmoratus*, Bloch, Ichthyologia, IX, 87, pl. 418, 1795; Günther, Cat., VIII, 15, 1870.
*Symbranchus immaculatus*, Bloch, *l. c.*, pl. 419, fig. 1.
*Synbranchus transversalis*, Bloch & Schneider, 524, 1801, Guinea, after Gronow.
*Unibranchapertura grisea*, *marmorata*, *immaculata*, and *lineata*, Lacépède, Hist. Nat. Pass., v, 658, 1803, Surinam.
*Synbranchus fuliginosus*, Ranzani, Nov. Comm. Ac. Sci. Inst. Bonon., IV, 75, plate 11, fig. 1, 1840, Brazil.
*Muræna lumbricus*, Gronow, Catalogue Fishes, 18, 1854, Sea of Guinea.
*Symbranchus vittatus*, Castelnau, An. Amer. Sud., 84, pl. 44, fig. 3, 1855, Rio de Janeiro.

## Order P. CARENCHELYI.

### (The Long-necked Eels.)

Teleost fishes with the intermaxillaries (premaxillaries), and supramaxillaries (maxillaries), developed and united by suture, and immovably connected with the cranium; branchial apparatus as in Apodes; scapular arch remote from the skull, and the body anguilliform. This order includes a single family, *Derichthyidæ*, lately discovered in the deep seas. (Gill.) (*κάρα*, head; *ἔγχελυς*, eel.)

### Family XLII. DERICHTHYIDÆ.

Body anguilliform, slender, with a neck-like contraction between the head and pectoral fins, and submedian anus. Scales absent, the skin being perfectly smooth. Lateral line commencing on the side, behind the head, near the back, but submedian behind. Head oblong, oval. Eyes in the anterior half of the head. Nostrils lateral, in front of the eyes, neither tubular. Mouth with the cleft little oblique, extending behind the eyes. Jaws well developed, maxillaries approximated to the front of the vomer and attenuated backwards. Mandible moderately stout; the dentary with the coronoid process moderate and not far from posterior end. Teeth conic, in cardiform bands on the jaws and vomer. Lips moderate. Tongue moderate. Preorbital bones and opercular apparatus moderately developed; operculum inserted rather low on the hyomandibular by a peduncle, horizontally oblong, with emarginate upper edge and convex lower one; suboperculum curved and applied below operculum; interoperculum long, connected in front with angle of jaw and behind with front of suboperculum; preoperculum moderate. Branchial apertures lateral; vertical slits in front of pectorals. Branchiostegal rays in small number, (about 6), rather slender and curved upwards behind the opercula. Dorsal, anal, and caudal confluent in an uninterrupted fin; dorsal commencing far behind the head; anal commencing about midway between snout and end of tail or middle of body; caudal pointed and reduced. Pectorals inserted nearer the breast than back, narrow and rather long, with about 10 or 11 fine rays, and bent forward. Branchial arches slender; glossohyal moderately long; urohyal very slender and pointed; first basibranchial very long; second and third basibranchials moderate; epipharyngeals reduced to a pair (?); hypopharyngeals long and closely appressed and superincumbent on the rudimentary fifth arch. One species known, an eel like fish, from the abysses of the Atlantic. (Gill.)

(*Derichthyidæ*, Gill, Amer. Nat., xviii, 1884, 433.)

### 149. DERICHTHYS, Gill.

*Derichthys*, Gill, American Naturalist, xviii, 1884, 433, (*serpentinus*).

The generic characters are included in the family diagnosis above. (*δέρη*, neck; *ἰχθύς*, fish.)

#### 573. DERICHTHYS SERPENTINUS, Gill.

Body stout, somewhat compressed, especially behind vent; greatest height in region of vent, nearly equal to head; its postanal portion equal to distance from vent to posterior margin of orbit. Head small, snake-like, its resemblance to that of a serpent being enhanced by the contracted neck-like appearance of the anterior portion of the body; its anterior portion depressed, the outline from above abruptly truncate; width of tip of snout considerably greater than interorbital space. Lower jaw narrower and included; upper jaw projecting beyond its tip a distance nearly equal to diameter of eye. Length of snout one-third that of head. Cleft of mouth extends behind eye a distance equal to or slightly greater than diameter of orbit. Nostrils elongate, the exterior slit occupying the middle third of the space between anterior margin of orbit and tip of snout. Length of neck four-fifths that of head, equal to distance from posterior limit of nostril to posterior portion of head. Pectorals inserted high up, almost in median line, and composed of 2 or 3 flexible, filiform rays. Origin of dorsal about midway between vent and tip of snout, the fin composed of flexible, delicate rays, not sufficiently differentiated from the thin membrane to be easily counted, those rays being longest in region above vent. Vent nearly median; anal fin beginning immediately behind vent, similar in height and appearance to dorsal fin, which it apparently joins at tip of tail. No ventrals. Lateral line inconspicuous, with minute pores, though its location is emphasized by the lancelet-like arrangement of the muscular fibers. Length of type 8 inches; of head, ½ inch; of region in advance of pectorals, 1 inch; greatest height, seven-sixteenths of an inch. Color, in life, ruddy brown; in alcohol, light yellow. (Goode & Bean.) A single specimen known. (*serpentinus*, like a snake.)

*Derichthys serpentinus*, Gill, Amer. Nat., xviii, 1884, 433, Gulf Stream, Albatross Station 2094, in 1022 fathoms. (Coll. Albatross.) Goode & Bean, Oceanic Ichthyology, 161, fig. 169, 1895.

## Order Q. APODES.

### (The Eels.)

Teleost fishes with the premaxillaries atrophied or lost, the maxillaries lateral, and the body anguilliform and destitute of ventral fins. The most striking feature is the absence of the premaxillaries, taken in connection with the elongate form and the little development of the scapular arch, which is not attached to the cranium. Other characters not confined to the Apodes are the following: The absence of the symplectic bone, the reduction of the opercular apparatus and of the palatopterygoid arch, the absence of ventral fins, the absence of the mesocoracoid or præcoracoid arch, and the reduction or total absence of the scales. There are no spines in the fins, the gill openings are comparatively small, and there are no pseudobranchiæ. The vertebræ are in large number* and none

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* *Numbers of vertebræ in Apodes.*

| | | | |
|---|---|---|---|
| *Murænesox coniceps* | 40 + 71 = 111. | *Lycodontis unicolor* | 65 + 71 = 136. |
| *Anguilla anguilla* | 46 + 70 = 116. | *Muræna helena* | 70 + 71 = 141. |
| *Echidna catenata* | 65 + 51 = 116. | *Ophichthus gomesi* | 45 + 96 = 141. |
| *Lycodontis meleagris* | 60 + 60 = 120. | *Lycodontis ocellatus* | 48 + 94 = 142. |
| *Lycodontis nebulosus* | 65 + 57 = 122. | *Lycodontis moringa* | 65 + 79 = 144. |
| *Lycodontis undulatus* | 64 + 68 = 132. | *Synaphobranchus pinnatus* | 31 + 115 = 146. |
| *Ophichthus ocellatus* | 52 + 82 = 134. | *Leptocephalus conger* | 55 + 99 = 154. |
| *Echidna zebra* | 97 + 38 = 135. | *Gordiichthys irretitus* | 125 + 100 = 225. |

of them are specially modified. The tail is isocercal; that is, with the caudal vertebræ remaining in a straight line to its extremity, as in the embryos of most fish, and in the *Anacanthini.*

We begin our discussion of the eels with the forms which seem nearest to the primitive stock from which the members of the group have descended. It is evident that among the eels, the forms of simplest structure, as *Uropterygius*, *Channomurœna*, and *Sphagebranchus* are not in any sense primitive forms, but the results of a long continued and progressive degeneration, so far as the fins and mouth parts are concerned. The *Apodes* are probably descended from *Isospondylous* or *Iniomous* types, possibly from ancestors of the *Anacanthini*, and their divergence from typical forms is, in most respects, a retrogression.* (*a*, without; πούς, foot, from the absence of ventral fins.)

(*Murænidæ*, GÜNTHER, Cat., VIII, 19–145, 1870.)

## FAMILIES OF APODES.

ENCHELYCEPHALI:

- *a.* Gill openings well developed, leading to large interbranchial slits; tongue present; opercles and branchial bones well developed; scapular arch present.
  - *b.* Skin covered with rudimentary embedded scales, usually linear in form, arranged in small groups, and placed obliquely at right angles to those of neighboring groups; pectorals and vertical fins well developed, the latter confluent about the tail; lateral line present; posterior nostril in front of eyes; tongue with its margins free.
    - *c.* Gill openings well separated; branchiostegals long, bent upwards behind.
      - *d.* Gill openings lateral and vertical; snout conic, the jaws not very heavy; gape longitudinal; lips thick; lower jaw projecting; teeth in cardiform bands on jaws and vomer; eggs minute. ANGUILLIDÆ, XLIII.
      - *dd.* Gill openings horizontal, inferior.
        - *e.* Snout very blunt, with very strong jaws; gape transverse; lips obsolete; teeth blunt, in one series, on jaws only. SIMENCHELYIDÆ, XLIV.
        - *ee.* Snout conical and slender, the jaws of moderate strength; gape lateral; lips obsolete; tongue but little developed; teeth acute, in bands on jaws and vomer. ILYOPHIDÆ, XLV.
    - *cc.* Gill openings inferior, very close together, apparently confluent; branchiostegal rays abbreviated behind; head conical; tongue small; posterior nostrils in front of eye. SYNAPHOBRANCHIDÆ, XLVI.
  - *bb.* Scales wholly wanting; eggs (so far as known) of moderate size, much as in ordinary fishes.
    - *f.* Tip of tail with a more or less distinct fin, the dorsal and anal fins confluent around it; the tail sometimes ending in a long filament. Coloration almost always plain, brownish, blackish, or silvery, the fins often black-margined.
      - *g.* Posterior nostril without tube, situated entirely above the upper lip.
        - *h.* Tongue broad, largely free anteriorly and on sides; vomerine teeth moderate.
          - *i.* Pectoral fins well developed; body not excessively elongate; lower jaw not projecting; anterior nostril remote from eye. LEPTOCEPHALIDÆ, XLVII.
        - *hh.* Tongue narrow, adnate to the floor of the mouth or only the tip slightly free; vomerine teeth well developed, sometimes enlarged.
          - *j.* Jaws not attenuate and recurved at tip; gill openings well separated; anterior nostrils remote from eye.

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* For a detailed account of the species of Apodes, see "A Preliminary Review of the Apodal Fishes or Eels," Rept. U. S. Fish Comm., 1888, (first published June 14, 1892), pp. 581–677, by David Starr Jordan and Bradley Moore Davis.

*k.* Pectoral fins well developed; skin thick; skeleton firm; snout moderate; tail not ending in a filiform tip. MURÆNESOCIDÆ, XLVIII.

*kk.* Pectoral fins wholly wanting; snout and jaws much produced, the upper longer; jaws straight; skin thin, the skeleton weak; tail ending in a filiform tip; gill openings small, subinferior; teeth sharp, subequal, recurved; a long series on the vomer; deep-sea eels, soft in body, black in color. NETTASTOMIDÆ, XLIX.

*jj.* Jaws long and slender, tapering to a point, recurved at tip; nostrils large, both pairs close in front of eye; gill openings convergent forward, separate or confluent; pectorals and vertical fins well developed; membranes of fins thin, not enveloping the rays; skeleton well developed; deep-sea eels. NEMICHTHYIDÆ, L.

*gg.* Posterior nostril close to the edge of the upper lip; tongue more or less fully adnate to the floor of the mouth; teeth subequal. MYRIDÆ, LI.

*ff.* Tip of tail without rays, projecting beyond the dorsal and anal fins (not filiform); posterior nostril on the edge of the upper lip; anterior nostril near tip of snout, usually in a small tube; tongue usually adnate to the floor of the mouth. Coloration frequently variegated. OPHICHTHYIDÆ, LII.

COLOCEPHALI:

*aa.* Gill openings small, roundish, leading to restricted interbranchial slits; tongue wanting; pectoral fins (typically) wanting; opercles feebly developed; fourth gill arch modified, strengthened, and supporting pharyngeal jaws.

*l.* Scapular arch obsolete or represented by cartilage; heart not far back; pectorals wanting; skin thick; coloration often variegated. MURÆNIDÆ, LIII.

## Suborder ENCHELYCEPALI.

### (THE EELS.)

The characters of this group are given above. (ἔγχελυς, eel; κεφαλή, head.)

## Family XLIII. ANGUILLIDÆ.

### (THE TRUE EELS.)

The true eels or *Anguillidæ* are characterized by their scaly skin in association with a conical head and a general resemblance to the *Congers*. The group is thus diagnosed by Dr. Gill:

Enchelycephalous Apodals with conical head, well-developed opercular apparatus, lateral maxillines, cardiform teeth, distinct tongue, vertical lateral branchial apertures, continuous vertical fins, with the dorsal far from the head, pectorals well developed, scaly skin, and nearly perfect branchial skeleton.

The *Anguillidæ* approach more nearly than most of the other eels to the type of the true fishes. In one respect, that of the minute ova and concealed generation, however, they differ widely from these. The single genus of living *Anguillidæ* is widely diffused in temperate and tropical waters. Unlike the other eels the *Anguillidæ* freely ascend the rivers, descending to the sea for purposes of reproduction. One genus, with 5 or more valid species. (*Murænidæ*, genus *Anguilla*, GÜNTHER, Cat., VIII, 23 to 37, 1870.)

*a* Dorsal fin inserted well behind base of pectorals, shoulder girdle well developed; lower jaw projecting. ANGUILLA, 150.

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## 150. ANGUILLA, Shaw.

### (EELS.)

*Anguilla*, SHAW, General Zoölogy, IV, 15, 1804, (*anguilla*).
*Muræna*, BLEEKER, POEY, etc., (taking as type *Muræna anguilla*, the first species mentioned by ARTEDI under *Muræna*).

Body elongate, compressed behind, covered with embedded scales which are linear in form and placed obliquely, some of them at right angles to others. Lateral line well developed. Head long, conical, moderately pointed, the rather small eye well forward and over the angle of the mouth. Teeth small, subequal, in bands on each jaw and a long patch on the vomer. Tongue free at tip. Lips rather full, with a free margin behind, attached by a frenum in front. Lower jaw projecting. Gill openings rather small, slit-like, about as wide as base of pectorals and partly below them. Nostrils superior, well separated, the anterior with a slight tube. Vent close in front of anal. Dorsal inserted at some distance from the head, confluent with the anal around the tail. Pectorals well developed. Species found in most warm seas, (the eastern Pacific excepted), ascending streams, but mostly spawning in the sea. The eels often move for a considerable distance on land, in damp grass. Waterfalls, dams, and other obstructions are often passed in this way. It is thought that the eel spawns only in the sea, the female dying after having once produced ova. The females are larger than the males, paler in color, with smaller eyes and higher fins. Eels are among the most voracious of fishes. " On their hunting excursions, they overturn alike huge and small stones, beneath which they find species of shrimp and crayfish, of which they are excessively fond. Their noses are poked into every imaginable hole in their search for food, to the terror of innumerable small fishes." (W. H. Ballou.) The single American species differs* slightly from the European *Anguilla anguilla* (Linnæus). (*anguilla*, the eel.)

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*As is shown in the following analysis:

*a*. Distance between origin of dorsal and vent ⅚ to 1¼ in head ; pectoral 3 to 3⅔ in head ; head 2½ to 2⅘ in trunk; upper jaw 3¾ to 4¼ in head. Yellow, brown, or black, underparts paler. ANGUILLA.

*aa*. Distance between origin of dorsal and vent 1⅙ to 2 in head ; pectoral 2⅚ to 3⅖ in head ; head 2 to 2½ in trunk; body more robust and trunk slightly shorter than in *anguilla*, otherwise similar. CHRYSYPA, 568.

Dr. Günther states that a specimen of the European eel from New Jersey is in the Liverpool Museum. There is no other American record, and this must be regarded as very questionable.

Dr. Seth E. Meek, (Bull. U. S. Fish Comm., 1883, 430), after a careful comparison of American and European eels, concludes that "in American specimens the dorsal fin is proportionately farther from the end of snout, making the distance between front of dorsal and front of anal a little shorter than in European specimens. Otherwise no permanent difference seems to exist. We should not, therefore, in my opinion, consider the two as distinct species, but rather as geographical varieties of the same species."

In *A. chrysypa*, according to Dr. Meek, the distance from tip of snout to front of dorsal is, on an average, .33½ of the length; the distance from front of dorsal to front of anal, .09¾, or less than length of head, (.12½).

In the European *Anguilla anguilla* the first distance is .30½, the second, .13⅔, or a little more than length of head (.13⅕). Cuban specimens, (*Anguilla cubana*, Kaup), agree fully with *A. chrysypa*, as also Texan ones (*Anguilla* "*tyrannus*" or "*texana*"). Probably our eel should be regarded as a subspecies, (*chrysypa*), of *A. anguilla*.

### 574. ANGUILLA CHRYSYPA,* Rafinesque.

(AMERICAN EEL; FRESH WATER EEL.)

Distance from front of dorsal to vent 1⅙ to 2 in head; pectoral 2⅚ to 3⅗ in head; head 2 to 2½ in trunk. Form rather robust. . Brown, nearly plain, often tinged with yellowish; paler below, the color extremely variable. Length 4 or 5 feet. Atlantic coast of the United States; very abundant from Maine to Mexico; ascending all rivers south of Canada and east of the Rocky Mountains and resident throughout the Mississippi Valley. Common in the West Indies. Not found in the Pacific. A food-fish of importance. (χρυσός, gold; ὑπό, below.)

*Anguilla chrysypa*, RAFINESQUE, Amer. Month. Mag. & Crit. Rev., 1817, 120, Lake George; Hudson River; Lake Champlain.
*Anguilla blephura*, RAFINESQUE, Amer. Month. Mag. & Crit. Rev., 1817, 120, Long Island.
*Anguilla laticauda*, RAFINESQUE, Amer. Month. Mag. & Crit. Rev., 1817, 445, Ohio River.
*Anguilla aterrima*, RAFINESQUE, Ich. Ohiensis, 78, 1820, Tennessee and Cumberland rivers.
*Anguilla xanthomelas*, RAFINESQUE, Ich. Ohiensis, 78, 1820, Ohio River.
*Anguilla lutea*, RAFINESQUE, Ich. Ohiensis, 78, 1820, Ohio River.
*Muræna rostrata*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., 1821, 81, Cayuga Lake.
*Muræna bostoniensis*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., 1821, 81, Boston.
*Muræna serpentina*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., 1821, 82, Newport, Rhode Island.
*Muræna macrocephala*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., 1821, 82, Saratoga, New York.
*Muræna argentea*, LE SUEUR, Journ, Ac. Nat. Sci. Phila., 1821, 82, Boston Bay.
*Anguilla tenuirostris*, DE KAY, Fishes N. Y., 310, 1842, New York.
*Anguilla novæorleanensis*, KAUP, Apodes, 43, fig. 33, 1856, New Orleans, Louisiana.
*Anguilla punctatissima*, KAUP, Apodes, 44, 1856, Niagara River.
*Anguilla cubana*, KAUP, Apodes, 44, 1856, Cuba.
*Anguilla novæterræ*, KAUP, Apodes, 45, fig. 35, 1856, Newfoundland.
*Anguilla texana*, KAUP, Apodes, 45, fig. 36, 1856, Texas.
*Anguilla wabashensis*, KAUP, Apodes, 46, 1856, Wabash River.
*Anguilla tyrannus*, GIRARD, U. S. and Mex. Bound. Surv., 75, 1859, Rio Grande.
*Anguilla rostrata*, DE KAY, Fishes N. Y., 312, 1842.
*Muræna cubana*, POEY, Synopsis, 421, 1868.
*Anguilla anguilla rostrata*, MEEK, Bull. U. S. Fish Comm., III, 1883, 430.
*Anguilla chrysypa*, JORDAN & DAVIS, Review of Apodal Fishes, 668, 1892.

## Family XLIV. SIMENCHELYIDÆ.

(THE SNUB-NOSED EELS.)

This family contains a single species, a large deep-sea eel, parasitic in larger fishes, having the general characters of *Anguilla*, but with the form of the head strikingly different. The following diagnosis is given by Dr. Gill:

Apodal fishes with a blunt snout, transverse, anterior mouth, massive jaws with an acrodont dentition, and inferior longitudinal branchial slits moderately far apart from each other.

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*Among the multitudes of American eels examined by us we have been unable to detect specific differences. As all these specimens differ in a slight degree from any we have seen from Europe, we may provisionally recognize the American form under its oldest name, *Anguilla chrysypa*, as a distinct species. As these differences are slight, it is not unlikely that intermediate forms may occur, in which case the American form may stand as var. *chrysypa*. Dr. Bean records in the "Nineteenth Report of the Commission of Fisheries of New York," page 280, five individuals from Great South Bay, Long Island, which he thinks may represent *Anguilla argentea* (Le Sueur). These specimens are described as having "large eyes, short snout, and long pectoral fins as compared with the common form, silvery gray above with a clear satiny white abdomen separated from the color above by the lateral line." These specimens are very interesting because they were found "to be males with the generative glands so well developed as to leave no doubt concerning the sex."

The skin has the peculiar rudimentary scales of *Anguilla*; the teeth are blunt, uniserial, on the edge of the jaws only, and there are no lips.

### 151. SIMENCHELYS, Gill.

*Simenchelys*, Gill, in Goode & Bean, Bull. Essex Inst., 27, 1879, (*parasiticus*).
*Conchognathus*, Collett, Bull. Soc. Zoöl. France, 122, 1889, (*grimaldii*).

Body eel-shaped, covered with linear embedded scales, disposed at right angles as in *Anguilla*. Lateral line present, faint. Head very short, rounded, very blunt anteriorly, slightly compressed. Mouth small, entirely anterior. Premaxillaries and maxillaries of each side coalesced and separated from those of the other side by the ethmoid. Jaws equal, their edges hard, provided with a single series of small, rounded, close-set, incisor-like teeth. No vomerine teeth. Tongue broad, somewhat free anteriorly. Mandible very deep and strong. Operculum saber-shaped. Gill openings very small, inferior, longitudinal, well separated, situated in front of the pectorals and below them. Both nostrils large, the anterior with a slight rim, but no tube. Lips full. Pectorals short; vertical fins confluent around the tail, the dorsal beginning not far behind pectorals; vent in front of anal, near middle of body. One species known. (*σιμός*, pug-nosed; *ἔγχελυς*, eel.)

#### 575. SIMENCHELYS PARASITICUS, Gill.

Eye 1½ to 2 in snout; pectoral 2½ in head; head 4⅓ to 4⅔ in trunk; tail a head's length longer than head and trunk; anterior profile of head bluntly rounded; angle of mouth at a point half way between the tip of snout and anterior edge of eye; body stout, the depth at vent about equal to length of head; dorsal beginning about a head's length behind gill openings; color dark brown, nearly plain. Length about 2 feet. Offshore banks, in deep water, south of Newfoundland; also recorded from the Azores; abundant; often found burrowing in the flesh of the halibut, (whence the name *parasiticus*, parasitic.)

*Simenchelys parasiticus*, Gill MS., in Goode & Bean, Bull. Essex, Inst., 27, 1879, Newfoundland Banks; Bean, Proc. U. S. Nat. Mus., 1880, 113; Jordan & Gilbert, Synopsis, 363, 1883; Günther, Voy. Challenger, xxii, 252, 1887; Jordan & Davis, *l. c.*, 670.
*Conchognathus grimaldii*, Collett, Bull. Soc. Zoöl. France, 122, 1889, Azores.

## Family XLV. ILYOPHIDÆ.

### (The Ooze Eels.)

This family contains a single species with characters intermediate between the *Simenchelyidæ* and the *Synaphobranchidæ*, combining the general physiognomy of *Synaphobranchus* with the separate gill slits and long-bowed branchiostegal rays of *Simenchelyidæ*. Deep-sea eels from the eastern Pacific.

### 152. ILYOPHIS, Gilbert.

*Ilyophis*, Gilbert, Proc. U. S. Nat. Mus., 1891, 351, (*brunneus*).

Body scaly; pectorals well developed; lateral line prominent; gill slits horizontal, inferior, well separated; nostrils lateral, the posterior immediately in front of the eye, the anterior with a short tube, near tip of snout. Maxillaries as in *Synaphobranchus*; the clamping processes closely appressed to the side of the vomer behind its head; lower jaw strong, apparently with the coronoid process well developed; series of teeth on head and shaft of vomer continuous; no lips; tongue little developed, with narrow free margin; branchiostegal rays 15 in number, (as determined without dissection), not shortened, some of them curved around and above the opercle. Dorsal, anal, and caudal confluent, rather high, the rays clearly visible through the skin; dorsal beginning well forward, its origin immediately behind the base of pectorals; origin of anal near end of anterior third of body. (*ίλύς*, ooze; *ὄφις*, snake.)

### 576. ILYOPHIS BRUNNEUS, Gilbert.

Body narrow, compressed throughout; snout and jaws slender; gape one-half length of head, extending beyond the eye for a distance less than the diameter of the latter; maxillary teeth small, bluntly conic, in narrow bands; teeth on vomer large, conic, those on shaft of vomer in a single row; teeth in mandible in narrow band, those on the inner series enlarged and retrorse though less than half the size of the vomerine teeth; front of pupil over end of second third of length of jaw; gill slits narrow, inferior, horizontal, crescent-shaped, about equaling horizontal diameter of eye, their lower (anterior) ends separated by a distance equal to their own length, their upper (posterior) ends by 1½ times that distance; head 2 in trunk; head and trunk 3¼ in total length; pectorals small, 6 in head, rays evident; scales very fine, arranged in groups at right angles to one another; lateral line running high anteriorly, its pores white and conspicuous. Color brown, the fins, lower side of head, and branchial regions darker. (Gilbert.) Length 15 inches. One specimen, from Chatham Island, Galapagos Archipelago, in 634 fathoms. (*brunneus*, brown.)

*Ilyophis brunneus*, GILBERT, Proc. U. S. Nat. Mus., 1891, 352, Chatham Island; JORDAN & DAVIS, *l. c.*, 670. (Coll. Albatross.)

## Family XLVI. SYNAPHOBRANCHIDÆ.

This group consists of deep-sea eels, differing from the *Anguillidæ* in having the gill openings externally confluent into a single slit. The following diagnosis is given by Dr. Gill:

Enchelycephalous Apodals with conic, pointed head, moderate opercular apparatus, lateral maxillines, cardiform teeth, distinct tongue, inferior branchial apertures discharging by a common aperture, continuous vertical fins, pectorals well developed, scaly skin, and nearly perfect branchial skeleton.

Body eel-shaped, covered with linear, imbedded scales placed at right angles, as in *Anguilla*. Lateral line present. Head long and pointed, the snout produced. Mouth very long, the eye being over the middle of its cleft. Jaws about equal; teeth small, sharp, in a broad band in each jaw, becoming a single series anteriorly; those of inner series in upper jaw and of outer series in mandible somewhat enlarged; vomerine teeth in a narrow band anteriorly. Gill openings inferior, horizontal, close together, convergent forward, somewhat confluent at the surface, but separated by a considerable isthmus within. Branchiostegals peculiarly formed, in moderate number (about 15), attached to the sides of the compressed ceratohyal and ephiyal, slender, abbreviated, and moderately bowed, not being curved up above the operculum. Tongue long, free only at the sides. Nostrils large, the anterior with a short tube, the posterior before the lower part of the eye. Pectoral well developed; dorsal low, beginning behind vent; anal longer than dorsal, rather high, its rays slender, branched, not imbedded in the skin; vertical fins confluent around the tail. Vent near the anterior fourth of body. Muscular and osseous systems well developed. Stomach very distensible. Deep-sea fishes; two genera with 6 or 8 species known. (*Murænidæ*, group *Synaphobranchina*, Günther, Cat., VIII, 22–23.)

*a.* Dorsal fin low, beginning behind vent; vomerine teeth in a single patch; pectorals long, longer than the rather slender snout. SYNAPHOBRANCHUS, 153.

*aa.* Dorsal fin beginning close behind base of pectorals; vomerine teeth in two patches, one behind the other; pectorals short, not longer than the short snout. HISTIOBRANCHUS, 154.

## 153. SYNAPHOBRANCHUS, Johnson.

*Synaphobranchus*, JOHNSON, Proc. Zoöl. Soc. London, 1862, 169, (*kaupii*).

Dorsal beginning behind vent. This genus contains two or three species, deep-sea fishes from the Atlantic and Pacific. (*συνăφής*, united; *βράγχια*, gills.)

### 577. SYNAPHOBRANCHUS PINNATUS (Gronow).

Dorsal fin beginning ¼ to ½ head's length behind vent; maxillary reaching a point almost opposite gill opening; head 3 to 3½ in distance from tip of snout to dorsal, ¼ to ¾ in trunk; snout 3½ in head; eye 2 to 2¼ in snout; cleft of mouth 1½ to 1¾ in head; pectorals 3 in head, their insertion about equidistant from snout and anus. Uniform brown, vertical fins darker behind, light-edged anteriorly; inside of mouth blue-black; gill openings dark. North Atlantic and western Pacific, common about the Madeiras, Canaries, etc., and also about the banks of Newfoundland; "a common resident of the deep waters of the offshore banks in 200 to 300 fathoms, where individuals are often taken on the fisherman's trawl lines." The Japanese species, *S. affinis*, Günther, is probably the same. (*pinnatus*, feathered or finned.)

*Muræna pinnata*, GRONOW, Cat. Fish. Brit. Mus., 19, 1854, locality unknown.
*Synaphobranchus kaupii*, JOHNSON, Proc. Zoöl. Soc. Lond., 1862, 169, Madeira. (Coll. J. Y. Johnson.)
? *Synaphobranchus affinis*, GÜNTHER, Ann. and Mag. Nat. Hist., XX, 1877, 445, Inosima, Japan.
*Synaphobranchus pinnatus*, GÜNTHER, Cat., VIII, 23, 1870; GOODE & BEAN, Bull. Essex Inst., 26, 1879; BEAN, Proc. U. S. Nat. Mus., 1880, 113; GOODE & BEAN, Bull. Mus. Comp. Zoöl., 222, 1883; JORDAN & GILBERT, Synopsis, 364, 1883; GÜNTHER, Voy. Challenger, XXII, 253, 1887; VAILLANT, Voyage Travailleur et Talisman, 89, 1888; JORDAN & DAVIS, *l. c.*, 672.

## 154. HISTIOBRANCHUS, Gill.

*Histiobranchus*, GILL, Proc. U. S. Nat. Mus., 1883, 255, (*infernalis*).

This genus is close to the preceding, from which it is distinguished by the more anterior insertion of its dorsal. Two species have been described, perhaps identical with each other. (*ιστίον*, sail, i. e. dorsal fin; *βράγχια*, gills; from the insertion of the dorsal.)

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|---|---|
| *a.* Pectoral fin longer than snout. | BATHYBIUS, 578. |
| *aa.* Pectoral fin shorter than snout. | INFERNALIS, 579. |

### 578. HISTIOBRANCHUS BATHYBIUS, Günther.

Pectoral fin longer than snout; eye $\frac{1}{2}$ or $\frac{2}{3}$ of the length of snout; head and trunk $1\frac{1}{4}$ in tail; dorsal commencing above or immediately behind the pectoral, which is only $\frac{1}{3}$ length of head; scales quite rudimentary, lanceolate, imbedded in the skin; cheeks naked; dorsal and anal fins low, especially the former. Uniformly black. (Günther.) Northern and western Pacific in deep water, Bering Strait, off Japan, and off Cape of Good Hope. One specimen obtained by Dr. Gilbert in Bering Sea in 1890, (Albatross Explorations). (*βαθύς*, deep; *βίος*, life.)

*Synaphobranchus bathybius*, GÜNTHER, Ann. and Mag. Nat. Hist., xx, 1877, 445; and in Voy. Challenger, 254, pl. LXII, fig. b, 1887, off Yedo; North Pacific; Kerguelen Island.
*Histiobranchus bathybius*, JORDAN and DAVIS, *l. c.*, 673.

### 579. HISTIOBRANCHUS INFERNALIS, Gill.

Body moderately elongated and compressed; its height at the anus $\frac{56}{100}$ of the length. Head 9 in total length, its width a little less than one-half its length; snout moderate, less than greatest width of head; eye moderate, much less than one-half the snout; upper jaw nearly one-tenth of total length; lower jaw a little more. Dorsal commencing not far behind vertical from the root of pectoral; anal inserted a little nearer tip of snout than end of tail; both are moderately developed. Pectorals considerably shorter than snout. Color in life almost uniform dark plumbeous; in alcohol the trunk is dark yellowish brown, becoming almost black on the abdominal region, as well as on the intermandibular integuments and around the pectorals, while the dorsal and anal are whitish except towards the posterior fourth of the length, where they are very dark or blackish. A specimen, No. 33279, was taken by the *Albatross* at station 2037, in 1,731 fathoms, 38° 30′ N. 69° 8′ W. (Goode & Bean.) (*infernalis*, infernal, from its black color.)

*Histiobranchus infernalis*, GILL, Proc. U. S. Nat. Mus., 1883, 255, Gulf Stream, Lat. 38° 30′ N., Long. 69° W., in 1,731 fathoms. (Type, No. 33279. Coll. Albatross.) GOODE & BEAN, Oceanic Ichthyology, 145, fig. 165, 1895.
*Synaphobranchus infernalis*, GÜNTHER, Challenger Report, XXII, 254, 1887.

## Family XLVII. LEPTOCEPHALIDÆ.

### (THE CONGER EELS.)

This family includes those eels which are scaleless, and have the tongue largely free in front, the body moderately elongate, the end of the tail surrounded by a fin, the posterior nostril remote from the upper lip and near front of eye, and the pectoral fins well developed. All the species are plainly colored, grayish or dusky above, silvery below, and the dorsal edged with black. Genera 3,* species about 15, found in most warm seas, usually at moderate depths. Most of the species undergo a metamorphosis, the young being loosely organized and transparent, band-shaped and with very small head. The body grows smaller with increased age, owing to the compacting of the tissues. (*Murænidæ*, part, Günther, Cat., VIII, 37–44.)

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* As the osteology of most of the species is unknown, we can not say whether the *Murænesocidæ*, *Echelidæ*, and *Heterocongridæ* should really be separated from this group. Bleeker places all these genera with *Nettastoma* and *Nemichthys*, also in his family of *Congroidei*. Günther approximates *Conger* to *Anguilla*, while recognizing the allies of *Murænesox*, *Echelus*, *Heteroconger*, and *Nemichthys* as so many distinct subfamilies. *Nettastoma* he places with *Neoconger* and *Murænesox*.

*a.* Vomerine teeth in bands, none of them canine-like; lips thick.
  *b.* Dorsal fin inserted at a point behind base of pectoral, but nearer pectoral than vent; head with inconspicuous mucous cavities; jaws with an outer series of close-set teeth, forming a cutting edge; tail about half longer than rest of body. LEPTOCEPHALUS, 155.
  *bb.* Dorsal fin beginning over the gill opening; bones of front of head with large muciferous cavities; mouth rather small; jaws with bands of small teeth, the outer not forming a cutting edge; tail from half to two-thirds of total length. CONGERMURÆNA, 156.
*aa.* Vomerine teeth uniserial, some of them canine-like; maxillary teeth biserial; dorsal beginning above root of pectoral; cleft of mouth extending beyond middle of eye; tail very long and slender, about half longer than rest of body. UROCONGER, 157.

## 155. LEPTOCEPHALUS (Gronow) Scopoli.

### (CONGER EELS.)

#### (*a*) LARVAL FORMS.

*Leptocephalus*, SCOPOLI, Int. Hist. Nat., 453, 1777, (*morrissi*).
*Oxyurus*, RAFINESQUE, Caratteri, 19, 1810, (*vermiformis*).
*Helmictis*, RAFINESQUE, Indice d'Ittiologia Siciliana, 62, 1810, (*punctatus*).
*Helmichthys*, COSTA, Fauna Napoli, Pesci, 1854, (*diaphanus*).
? *Leptocephalichthys*, BLEEKER, Act. Soc. Sci. Ind. Neerl., 1, Manado, 69, (*hypselosoma*).
? *Diaphanichthys*, PETERS, Monatsber Ak. Wiss. Berl., 399, 1864, (*brevicaudus*).

#### (*b*) ADULT FORMS.

*Echelus*, RAFINESQUE, Caratteri, etc., 63, 1810, (in part; includes species of *Conger*, *Ophisoma* and *Myrus*; restricted by Bleeker to *Myrus*).
*Conger*, CUVIER, Règne Animal, Ed. II, II, 350, 1829, (*conger*).
*Ariosoma*, SWAINSON, Nat. Hist., Class'n Fishes, I, 220, 1838, (no type mentioned; diagnosis worthless).
*Ophisoma*, SWAINSON, Nat. Hist., Class'n Fishes, II, 334, 1839, (*acuta*, *obtusa*). Substitute for *Ariosoma*; not *Ophisomus*, SWAINSON, *l. c.*, 227 = *Murænoides*, Lacépède.
*Congrus*, RICHARDSON, Voyage Erebus & Terror, 107, 1844, (*conger*).

Body formed as in *Anguilla*, the skin scaleless. Head depressed above, anteriorly pointed. Lateral line present. Mouth wide, its cleft extending at least to below middle of eye. Teeth in outer series in each jaw equal and close-set, forming a cutting edge; no canines; band of vomerine teeth short. Tongue anteriorly free. Vertical fins well developed, confluent around the tail; pectoral fins well developed; dorsal beginning close behind pectorals. Gill openings rather large, low. Eyes well developed. Posterior nostril near eye; anterior near tip of snout, with a short tube. Lower jaw not projecting. Skeleton differing in numerous respects from that of *Anguilla*. Vertebræ about 56 + 100. In most warm seas. This genus contains the well-known and widely distributed Conger eel and three or four closely related species. The earliest generic name used for members of the group is *Leptocephalus*, based on a curious, elongate, transparent, band-like creature with minute head and very small mouth, found in the waters of Europe, and known as *Leptocephalus morrissi.* This has been shown by Gill, Günther, and Facciolá to be the young and larval form of *Leptocephalus conger.* A number of the genera and species of the supposed family of Leptocephalidæ have been described, but there is no doubt that all of them are larvæ, some of eels, as *Conger*, *Congermuræna*, *Ophisurus*, and *Nettastoma*, others of Isospondylous fishes, as *Albula*, *Elops*, *Alepocephalus*, *Stomias*, etc. (See Günther, Cat., VIII, 136.) It is thought by Dr. Günther that the Leptocephalid forms are probably "individuals arrested in the development at a very early period of their life, yet continuing to grow to a certain size, without corresponding development of their internal organs, and perishing without having attained the characters of the perfect animal." The recent observations of Dr. Gilbert on the larvæ of *Albula*, *Elops*, and *Conger*, however, seem to point to the conclusion that these curious forms are normal young, and that the individuals grow smaller in size for a time with increased age, owing to the increasing compactness of the tissues.

Inasmuch as the name *Leptocephalus* has been associated for more than a century with larval forms it is a decided inconvenience to accord to it precedence as a generic name over *Conger.* The strict law of priority, however, demands its retention, and the tendency among systematic zoölogists is to recognize as few exceptions as may be to this rule. The unfamiliar names *Oxyurus* and *Helmictis* are both earlier than *Conger.* (*λεπτός*, slender; *κεφαλή*, head.)

*a.* Dorsal beginning nearly opposite tip of pectoral; head about 1⅘ in trunk. CONGER, 580.
*aa.* Dorsal fin beginning above middle of pectorals; head about 1⅗ in trunk. CAUDILIMBATUS, 581.

### 580. LEPTOCEPHALUS CONGER (Linnæus).

(CONGER EEL.)

Dorsal beginning opposite to or just behind tip of pectoral; eye 1½ in snout, 5 to 6 in head; snout 3¼ to 4¼ in head; gape extending nearly or quite to posterior margin of eye; head 1⅘ to $1\frac{6}{7}$ in trunk; tail longer than rest of body; pectorals 3½ in head; upper lip full, with conspicuous pores. Ashy gray or blackish; vertical fins with a black margin; body sometimes (var. *niger*) entirely black. Atlantic Ocean, generally common on both coasts, from Cape Cod to Brazil; also on coasts of Asia and Africa; almost cosmopolitan, but not found in the eastern Pacific. It reaches a length of 8 feet, and is a food fish of importance, especially in Europe. (*Conger*, the ancient name of the eel.)

(*a*) LARVAL FORMS.

*Leptocephalus morrissi*, GMELIN, Syst. Nat., 1150, 1788, Holyhead, England.
*Ophidium pellucidum*, COUCH, Lond. Mag. Nat. Hist., V., 1832, 313, 742, England.
*Leptocephalus gracilis*, STORER, Mem. Amer. Acad., II, 524, 1839, Massachusetts.
*Leptocephalus spallanzanii, candidissimus*, etc., of European writers.

(*b*) ADULT FORMS.

*Muræna supremo margine pinnæ dorsalis nigro*, ARTEDI, Synon., 40, 2, 1738, Mediterranean.
*Muræna conger*, LINNÆUS, Syst. Nat., X, 245, 1758, (based on Artedi).

*Muræna nigra*, Risso, Ich. Nice, 93, 1810, (black variety), Nice.
*Anguilla oceanica*, Mitchill, Journ. Ac. Nat. Sci. Phila., 1818, 407, off New York.
*Conger verus*, Risso, Eur. Mer., iii, 201, 1826, Nice.
*Conger vulgaris*, Cuvier, Règne Animal, Ed. ii, ii, 350, 1829, France; Günther, Cat., viii, 38, 1870.
*Conger rubescens*, Ranzani, De Novis Spec. Pisc. Diss. Prima, 19, pl. v, fig. 5, 1838, Mediterranean.
*Ophisoma obtusa*, Swainson, Fish., Rep., and Amph., ii, 395, 1839, Sicily.
*Conger orbignyanus*, Valenciennes, D'Orbigny, Voy. Am. Merid., Poiss., pl. 12, 1, 1839, South America.
*Conger occidentalis*, De Kay, N. Y. Fauna: Fishes, 314, pl. 53, fig. 172, 1842.
*Congrus leucophæus*, Richardson, Voy. Erebus and Terror, Fishes, 108, 1844.
*Conger verreauxi*, Kaup, Apodes, 115, 1856, no locality.
*Conger esculentus*, Poey, Memorias, ii, 346, 1860, Cuba.
*Conger niger*, Jordan & Gilbert, Synopsis, 362, 1883.
*Leptocephalus conger*, Jordan & Davis, *l. c.*, 664.

### 581. LEPTOCEPHALUS CAUDILIMBATUS (Poey).

Dorsal fin beginning above the middle of pectorals; eye as long as snout, 4½ in head; gape extending to beyond the middle of the eye; head 1½ to 1¾ in trunk; tail longer than rest of body; pectorals 3 to 3¼ in head. Brown, vertical fins with a broad black margin, which is again edged with white; the dorsal black anteriorly for ⅔ its depth. Tropical parts of Atlantic; Pensacola to Cuba and Madeira; not rare. (*cauda*, tail; *limbatus*, margined.)

*Echelus caudilimbatus*, Poey, Repertorio, ii, 249, 1867, Cuba.
*Conger macrops*, Günther, Cat., viii, 40, 1870, Madeira; Bahamas. (Coll. Hasslar.)
*Conger caudicula*, Bean, Proc. U. S. Nat. Mus., 1882, 435, Pensacola. (Type, No. 30709. Coll. Silas Stearns.) Jordan & Gilbert, *l. c.*, 262.
*Conger caudilimbatus*, Poey, Enumeratio, 152, 1875.
*Leptocephalus caudicula*, Jordan & Gilbert, Synopsis, 900, 1883.
*Leptocephalus caudilimbatus*, Jordan & Davis, *l. c.*, 666

## 156. CONGERMURÆNA, Kaup.

*Conger-Muræna*,[*] Kaup, Apodes, 108, 1856, (*balearica*).
*Gnathophis*, Kaup, Aale Hamb. Mus., 1859, (*heterognathus*).
*Congromuræna*, Günther, Cat., viii, 40, 1870, (amended spelling).
*Ophisoma*, Bleeker, Jordan & Davis, etc., (*acuta*).

This genus contains numerous species of small Congers, distinguished by the more anterior insertion of the dorsal and by the greater development of the muciferous cavities in the head. The species are very closely related and not well known. (*Conger*; *Muræna*; related genera.)

*a.* Snout more or less projecting beyond mandible.
  *b.* Vent submedian in position, the body and tail about equal in length; upper jaw little projecting. BALEARICA, 582.
  *bb.* Vent anterior in position, the tail much longer than rest of body.
    *c.* Snout short and heavy, blunt, projecting little beyond mandible. MACRURA, 583.
    *cc.* Snout long and acute, considerably projecting.

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[*] By the rules of the American Ornithologists' Union, the generic name *Congermuræna* would be adopted. *Ariosoma* is ineligible because no type is expressed, and the diagnosis is valueless. *Ophisoma* would by some be set aside on account of the prior *Ophisomus*. *Ophisoma* was based on two species, *acuta* and *obtusa*, the latter the common Conger Eel, and this group is really synonymous with Conger.

*d.* Tail less than twice length of rest of body ; eye small, 8⅓ in head ; mandible strong. PRORIGERA, 584.

*dd.* Tail much more than twice length of rest of body ; eye large, 7 in head. NITENS, 585.

*aa.* Snout long, but not projecting ; the lower jaw much longer than upper ; tail twice length of rest of body ; eye 6 in head. FLAVA, 586.

### 582. CONGERMURÆNA BALEARICA (De la Roche).

Upper jaw but little projecting; lips thin ; head about 6 in total length ; the tail a little longer than the head and trunk ; eye about equal to snout, 5 in head. Color brownish or yellowish ; silvery on sides and below ; vertical fins with a narrow black edge. Tropical parts of the Atlantic and eastern Pacific. Known from the Mediterranean, Cuba, Brazil, St. Helena, Cape San Lucas and the Galapagos. Possibly more than one species should be recognized, in which case the American form would stand as *C. opisthophthalmus.* (Eu.) (Name from the Balearic Islands, off the coast of Spain.)

*Muræna balearica*, DE LA ROCHE, Ann. Mus., XIII, 1809, 327, fig. 3, Balearic Islands.
*Echelus ciuciara*, RAFINESQUE, Caratteri, 65, 1810, Sicily.
*Muræna cassini*, RISSO, Ich. Nice, 91, 1810, Nice.
*Conger opisthophthalmus*, RANZANI, De Nov. Spec. Pisc. Disser., Prima. 16, pl. V, fig. 1, 1838, Bahia.
*Ophisoma acuta*, SWAINSON, Fish., Rept., Amph., II, 396, 1839, Sicily.
*Conger microstomus*, CASTELNAU, Anim. Nouv. Rares, Amérique du Sud, 83, pl. 42, fig. 4, 1855, Rio Janeiro.
*Conger analis*,[*] POEY, Memorias, II, 318, 1860, Havana.
*Conger impressus*, POEY, Memorias, II, 318, 1860, Cuba.
*Congromuræna mellissii*, GÜNTHER, Cat., VIII, 42, 1870, St. Helena. (Coll. J. H. Melliss.)
*Conger-Muræna balearica*, KAUP, Apodes, 110, 1856.
*Congromuræna balearica*, GÜNTHER, Cat., VIII, 41, 1870.
*Ophisoma analis*, POEY, Repertorio, II, 248, pl. 3, fig. 3, 1866.
*Ophisoma balearicum*, JORDAN & DAVIS, *l. c.*, 661.

### 583. CONGERMURÆNA MACRURA (Gilbert).

Vent anterior in position, the tail much longer than the body. Snout comparatively short and heavy, blunt, and broadly rounded, projecting but little beyond tip of mandible ; tail twice length of body ; lips full ; teeth in mandible in a broad band, those of outer series the largest ; maxillary and vomerine teeth also in broad bands ; vomerine patch divided by a groove into which fits the tip of the mandible ; no teeth on shaft of vomer ; posterior nostril an elliptical slit, on level of upper margin of pupil ; anterior nostril a round pore near tip of snout ; five large mucous pores on each side of jaws ; gape extending slightly beyond pupil, 2¾ in head ; eye moderate, ¾ in snout, 6 in head ; head 1⅕ in trunk, 4 in tail ; pectorals ⅓ length of head ; origin of dorsal slightly behind base of pectorals. Color dusky above ; under side of head and abdomen light, the two areas separated by a well-defined line ; fins dusky, becoming black towards tip of tail, with whitish border ; inside of mouth, gill cavity, and peritoneum silvery. (Gilbert.) Gulf of California ; one specimen known, 9½ inches long. (*μακρός*, long : *οὐρά*, tail.)

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[*] According to Poey the vent is exactly in the middle of the body in *Congermuræna analis*, and an eye's diameter nearer the head in *Congermuræna impressa.*

*Ophisoma macrurum*, GILBERT, Proc. U. S. Nat. Mus., 1891, 351, Gulf of California. (Coll. Albatross.)

### 584. CONGERMURÆNA PRORIGERA (Gilbert).

Tail considerably longer than rest of body. Eye small, 2 in snout, 8⅓ in head, slightly less than length of gill slit; snout long and sharp, the acute tip projecting beyond mandible for ⅔ length of orbit; teeth villiform, in broad bands, none of them enlarged, a transverse groove behind head of vomer to receive tip of mandible; posterior nostril slit-like, the anterior with distinct membranous tube; mandibles very broad and strong; gape reaching to vertical from posterior margin of pupil, ⅓ of head; conspicuous pore just behind angle of mouth; head equal to trunk, 3 in tail without fin; depth 13 in total length; pectoral 3½ in head; dorsal beginning in advance of gill opening, its distance from tip of snout slightly less than half the distance from snout to anal. Uniform light brown; fins dusky, black near tip of tail, and there with narrow bright white margin; mouth, gill cavity, and peritoneum black. (Gilbert.) Length 1 foot. Panama to Ecuador. (*prora*, prow; *gero*, I bear.)

*Ophisoma prorigerum*, GILBERT, Proc. U. S. Nat. Mus. 1891, 350, Coast of Ecuador; Panama. (Coll. Albatross.)

### 585. CONGERMURÆNA NITENS (Jordan & Bollman).

Tail much more than twice length of body; body slender; tail compressed; lower jaw considerably shorter than the upper; dorsal beginning slightly in advance of the root of the pectoral. Head 1⅐ in trunk, 5⅓ in tail; tail 2⅔ times as long as head and trunk; snout 4¼ in head, very soft; eye very large, 7 in head, 1⅔ in snout; interorbital area 2 in eye; cleft of mouth 3⅕ in head, extending slightly behind middle of eye; pectoral long and narrow, 2⅘ in head, 1¾ times as long as gill slit. Color olivaceous, upper parts of head and body with numerous fine black dots; a silvery shade across opercles and below lateral line; peritoneum bright silvery, giving belly a pale color; dorsal and anal with a narrow black margin, below which are a few small spots; pectoral pale. One specimen dredged at *Albatross* station 2801 off Panama, 8° 47′ N., 79° 29′ 30″ W., in 14 fathoms. (*nitens*, shining.)

*Ophisoma nitens*, JORDAN & BOLLMAN, Proc. U. S. Nat. Mus., 1889, 153, Panama; JORDAN & DAVIS, *l. c.*, 662. (Coll. Albatross.)

### 586. CONGERMURÆNA FLAVA, Goode & Bean.

Lips somewhat thickened. Snout long, about twice diameter of eye, which is 6 in head. Lower jaw projecting far beyond the upper. Anterior nostril in short tube, posterior nostril pore-like, in advance of eye, and above the horizontal line of its diameter. Cleft of mouth extending very slightly behind middle of eye. Teeth in very narrow bands, villiform, a dense cluster on the vomer. Length of head equal to that of trunk. Tail about twice as long as body. Dorsal beginning far in advance of gill opening and pectoral. Color yellowish; blackish on termination of tail. Specimens obtained by the *Albatross* at stations 2121 and 2122, in 31 to 34 fathoms, and at station 2402, in 111 fathoms;

also by the *Blake* at station 264, in 84 fathoms. (Goode & Bean.) (*flavus*, yellow.)

*Congermuræna flava*, GOODE & BEAN, Oceanic Ichthyology, 138, fig. 159, 1895, Gulf Stream. (Type, No. 44612. Coll. Albatross.)

### 157. UROCONGER, Kaup.

*Uroconger*, KAUP, Apodes, 110, 1854, (*lepturus*).

Mouth very large, its cleft passing middle of eye; vomerine teeth uniserial, some of them canine-like; teeth in jaws in two series. Tail long, slender, whip-like. Dorsal inserted above pectoral. Species few. (*οὐρά*, tail; Conger.)

#### 587. UROCONGER VICINUS, Vaillant.

Depth 20 in length. Vomer with two strong teeth anteriorly. Space separating gill openings considerably greater than their diameter. (Goode & Bean.) Deep waters off coast of northern Africa; a young individual taken by the *Albatross* at station 2161 in 146 fathoms. (*vicinus*, near, *i. e.* to *Uroconger lepturus*.)

*Uroconger vicinus*, VAILLANT, Exped. Travailleur et Talisman, 86, pl. VI., fig. 1, 1888, Banc d'Arguin, off Soudan, off Cape Verde Islands; GOODE & BEAN, Oceanic Ichthyology, 138, 1895.

## Family XLVIII. MURÆNESOCIDÆ.

Scaleless anguilloid eels, with the posterior nostril not labial, the tongue largely adnate, the jaws not excessively elongate, the end of the tail surrounded by the caudal fin, and the pectoral fins well developed. None of these characters appear to have in themselves great importance, but according to Dr. Gill, in the genus *Murænesox*, the only genus in which the osteology is well known, the characters are such as fully to justify family distinction. Dr. Gill gives the following diagnosis of Murænesocidæ:

"Enchelycephalous Apodals with the tongue not free, the branchiostegal membrane connecting the opposite sides below, the epipharyngeals reduced to one pair, and the hypopharyngeals linguiform and encroaching on the fourth branchial arch."

To this should be added: Gill openings rather wide; pectoral fins well developed; jaws of moderate length; vomer well armed.

Whether all these characters are found in the other genera commonly associated with *Murænesox* is not yet known. The family, as understood by us, seems divisible into two well-marked groups, which are, perhaps, as distinct from each other as from the *Echelidæ* or the *Congridæ*. The species of this family are not very numerous, and a large proportion are American. In general appearance and habits they approach the Congers. All are plainly colored and some descend to rather deep water. (*Murænidæ*, *Murænesocinæ*, Günther, Cat., VIII, 45–49.)

MURÆNESOCINÆ:

*a.* Dorsal and anal fins well developed throughout, the dorsal beginning nearly above gill opening; snout moderately produced; vomerine teeth very strong.

*b.* Teeth in jaws in several series; gill openings wide.

*c.* Teeth in jaws in several series, those of one series enlarged and compressed, long canines in front; vomer with several long series of teeth, the middle one of conical canines. MURÆNESOX, 158.
*cc.* Teeth all conical, slender and sharp, those of jaws in wide bands; maxillary with a deep groove, running the entire length of the bone, dividing the band of teeth into two portions; shaft of vomer with a median series of conical teeth. XENOMYSTAX, 159.
*bb.* Teeth in jaws biserial, small; vomer with a series of long, pointed canines; tail about 4 times as long as rest of body; gill openings narrow. HOPLUNNIS, 160.

STILBISCINÆ:
*aa.* Dorsal and anal fins very low anteriorly, developed chiefly on the tail.
*d.* Tail about as long as rest of body; teeth moderate; dorsal beginning before the vent.
*dd.* Tail short, little more than half as long as rest of body; teeth all uniserial, unequal, some of them canine-like; body very slender, whip-shaped.
*e.* Body moderately elongate, the diameter more than one-thirtieth the length; dorsal beginning just before vent. NEOCONGER, 161.
*ee.* Body whip-shaped, the diameter less than one-fiftieth the length.
*f.* Dorsal fin beginning not far behind pectoral. LEPTOCONGER, 162.
*ff.* Dorsal fin beginning behind the vent. STILBISCUS, 163.
*fff.* Dorsal fin beginning close behind the nape. GORDIICHTHYS, 164.

## 158. MURÆNESOX, McClelland.

*Murænesox*, **McClelland**, Calcutta Journ. Nat Hist., IV, 408, 1843, (*tricuspidata*).
*Cynoponticus*, **Costa**, Fauna Napoli, Pesci., pl. 28, 1850, (*ferox* = *savanna*).
*Brachyconger*, **Bleeker**, Nederl. Tidsskr., Dierkunde, II, 236, 1865, (*savanna*).
*Congresox*, **Gill**, Proc. U. S. Nat. Mus., 1890, 234, (*talabon*).

Body robust. Dorsal and anal fins well developed, the dorsal beginning nearly above gill opening. Mouth large; teeth in jaws in several series, those of one series enlarged and depressed, forming long canines in front; vomer with several long series of teeth, the middle one of strong canines. This genus contains numerous species, large, conger-like eels, some of which are found in all warm seas. They are remarkable for the strong armature of the vomer. (*Muræna*; *Esox*, pike.)

MURÆNESOX:
*a.* Median teeth on vomer enlarged, compressed, and cultrate; median teeth on side of lower jaw also enlarged and compressed or bluntish.
*b.* Middle series of teeth on vomer not distinctly tricuspidate; pectoral rather more than half head. CONICEPS, 588.
*bb.* Middle series of teeth on vomer distinctly tricuspidate in young, becoming entire with age; pectoral 2⅔ in head. SAVANNA, 589.

### Subgenus MURÆNESOX.

### 588. MURÆNESOX CONICEPS, Jordan & Gilbert.

Vomer with a median row of about 15 very large, strong teeth, which are much compressed, the tip angular and directed backwards, and with a nick on the posterior edge, thus: ; one or two of the anterior teeth only slightly tricuspidate; on each side of the median row on vomer some very small, blunt teeth, disappearing anteriorly, arranged in one or two rows very close to the median row; jaws with one or two outer rows of small, blunt teeth, next a row of rather large, wedge-shaped teeth, and then an inner band of small, conical, blunt teeth in two, three, or four series; front of both jaws with groups of canines, which are shorter than the pupil; in old examples the teeth, especially those on the vomer, are often so worn that their original form is not at all evident; head 2 in trunk, 3¾ in tail; pectoral fin 2 in the distance between the tip of snout and the base of the fin or rather more than half length of head; eye 2⅓ in the snout, 1½ in interorbital width, 3½ in cleft of mouth, situated a little behind middle of gape; cleft of mouth 2½ in the head; gill openings large, containing the isthmus twice; dorsal beginning over the gill openings. Olive-brown above, dull-whitish below; dorsal and anal light brown with a dark margin; caudal and pectoral fins black. Length 2 or 3 feet. Cape San Lucas to the coast of Columbia, generally common. Very close to the next, the difference in dentition evident only in the young. (*conus*, cone; *-ceps*, head.)

*Murænesox coniceps*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1881, 348, Mazatlan; JORDAN & DAVIS, *l. c.*, 648. (Type, No. 28136. Coll. Gilbert.)

### 589. MURÆNESOX SAVANNA (Cuvier).

Median series of teeth on vomer distinctly tricuspidate in the young, becoming entire with age, with nearly even surface, thus: ⊃; pectoral as long as maxillary, 2⅔ in head; eye 2 in snout, which is 4½ in head; dorsal inserted over the gill opening. Brown above, silvery below; dorsal and anal edged with black. Otherwise as in *M. coniceps*. Cuba to Rio Janeiro, not common, occasional in the Mediterranean Sea. (Eu.) (Called "Savanne" in Martinique.)

*Muræna savanna*, CUVIER, Règne Animal, Ed. 2, Vol. 2, 350, 1829, Martinique; BENNETT, Proc. Comm. Zoöl. Soc., 135, 1831.

*Conger brasiliensis*, RANZANI, Nov. Spec. Pisc. Diss. Prima., IV, 17, pl. 13, fig. 1, 1838, Brazil.

*Congrus curvidens*, RICHARDSON, Voy. Erebus & Terror, 111, 1844, no locality.

*Cynoponticus ferox*, COSTA, Fauna Napòli, Pesc., pl. 28, 1854, Naples.

*Conger limbatus*, CASTELNAU, Anim. Am. Sud, 83, pl. 43, fig. 3, 1855, Rio Janeiro.

*Brachyconger savanna*, BLEEKER, Atlas des Murènes Indes Orient, IV, 20, 1864.

*Murænesox savanna*, GÜNTHER, Cat., VIII, 47, 1870; JORDAN & DAVIS, *l. c.*, 648.

## 159. XENOMYSTAX, Gilbert.

*Xenomystax*, GILBERT, Proc. U. S. Nat. Mus., 1891, 348, (*atrarius*).

Scaleless; pectorals well developed; vertical fins large, continuous around the tail, the rays evident; dorsal beginning before base of pectorals. Gill slits vertical and rather wide, the gill membrane continuous below the throat. Branchiostegals apparently 11 or 12 in number, long and much curved, continuing around the posterior and upper edges of the opercles; mouth with wide lateral cleft, not extending far beyond eye; maxillaries very wide, not extending far forwards, the clasping processes applied to shaft of vomer well behind its head. Teeth all conical, slender, and sharp, mostly depressible, those in jaws in wide bands; maxillary with a deep lengthwise groove running the entire length of the bone and dividing the band of teeth into two portions; lower jaw much shorter than upper. Posterior nostril a linear slit, midway between eye and tip of snout; the anterior in a short tube just behind the head of vomer; tongue small, with the tip free; lips undeveloped; the lateral line conspicuous. One species. (*ξένος*, strange; *μύσταξ*, maxilla.)

### 590. XENOMYSTAX ATRARIUS, Gilbert.

Snout very long and slender; end of maxillary equidistant from tip of mandible and gill opening; front of orbit over the beginning of last third of gape; long slit-like pores on margin of upper jaw, a conspicuous series on mandible and preopercle; teeth in jaws in wide bands, mostly depressible; maxillary teeth divided by a deep groove running entire length of jaw, those on inner side of groove long, close-set, rigid, in single series; mandible with much narrower and shallower groove, on the inner edge of which is a single series of very small conical teeth, directed inwards; tip of mandible enlarged to form a knob which fits into a toothless depression just behind head of vomer, the vomer extending well beyond the tip of lower jaw; teeth on head of vomer and knob of mandible similar, slightly larger than those of side of jaw; anterior part of shaft of vomer with median series of strong conical teeth, accompanied by smaller lateral series and followed by a narrower band of very small conical teeth. Head equal to trunk and ⅓ of tail; gill openings broadly lunate, vertical length of slit ⅓ of snout, interspace ⅔ length of slit; pectorals narrow, ½ snout. Color very dark brown; fins black; pores of lateral line white. (Gilbert.) Coast of Ecuador, at *Albatross* station 2792, in 401 fathoms. (*atrarius*, blackish.)

*Xenomystax atrarius*, GILBERT, Proc. U. S. Nat. Mus., 1891, 348, Lat. 1° S., Long. 81° W. (Coll. Gilbert.)

## 160. HOPLUNNIS, Kaup.

*Hoplunnis*, KAUP, Aale Hamburg Museum, 19, 1859, (*schmidtii*).

This genus differs from *Murænesox* chiefly in the dentition; the teeth in the jaws are small and biserial and the vomer has a series of long, pointed canines. The very long tail is four times length of rest of body. Gill openings wide. Two species, American. (*ὅπλον*, armature; *ὕννις*, vomer; correctly written *Hoplynnis*.)

*a.* Eye 3 in snout; tail four times rest of body. SCHMIDTII, 591.
*aa.* Eye 3 to 3⅔ in snout; cleft of mouth extending beyond eye. DIOMEDIANUS, 592.

### 591. HOPLUNNIS SCHMIDTII, Kaup.

Tail about four times as long as rest of body; eye 3 in snout; posterior portion of vertical fins black. (Kaup per Günther.) Caribbean Sea at Puerto Cabello; one specimen known and very imperfectly described. (A personal name.)

*Hoplunnis schmidtii*, KAUP, Aale Hamb. Mus., 19, pl. 2, fig. 4, 1859, Puerto Cabello; GÜNTHER, Cat., VIII, 49, 1870.

### 592. HOPLUNNIS DIOMEDIANUS, Goode & Bean.

Allied to *H. schmidtii*, with height of body 4 in head; its width ⅔ its height. Snout 3 to 3⅔ times eye. Cleft of mouth extends slightly beyond hind margin of eye. Teeth in jaws small, pointed, in narrow bands, the inner series of the lower jaw consisting of enlarged, widely separated canines a pair of larger canines near the end of the lower jaw in the example figured; a row of six to eight strong, large canines on the vomer. A single individual (No. 44240 U. S. Nat. Mus.) was obtained by the *Albatross* at station 2402, Gulf of Mexico, 111 fathoms, lat. 28° 36′, long. 86° 50′. (Goode and Bean.) (Named for the Albatross, *Diomedea*.)

*Hoplunnis diomedianus*, GOODE & BEAN, Oceanic Ichthyology, 146, 1895, Gulf of Mexico.

## 161. NEOCONGER, Girard.

*Neoconger*, GIRARD, U. S. Mex. Bound. Surv., Ichth., 77, 1859, (*mucronatus*).

Body moderately elongate, not whip-like. Pectoral fins present; vertical fins rudimentary, passing around the tail, towards the end of which they are more developed; dorsal beginning just before vent. Cleft of mouth extending beyond the small eye; maxillary teeth slender, in several series; vomerine teeth uniserial, forming a patch in front; tail not much longer than rest of body. Gill openings vertical, rather large. Two species. (*νέος*, new; Conger.)

| | |
|---|---|
| *a*. Pectoral small; Gulf of Mexico. | MUCRONATUS, 593. |
| *aa*. Pectoral well developed, 3½ to 4 in head; Pacific Ocean. | VERMIFORMIS, 594. |

### 593. NEOCONGER MUCRONATUS, Girard.

Head small, slender, pointed; upper jaw the longer; dorsal fin beginning just in front of the vent, forming a membranous ridge until near the tail, where it expands and becomes fin-like; pectorals small. Dark reddish brown above, paler below. Coast of Texas. (Girard.) One specimen known; the imperfect description not distinguishing it from *N. vermiformis*. (*mucronatus*, mucronate.)

*Neoconger mucronatus*, GIRARD, U. S. Mex. Bound. Surv., Ichth., 77, 1859, St. Joseph Island, Texas. (Coll. Würdemann.) GÜNTHER, Cat., VIII, 49, 1870; JORDAN & GILBERT, Synopsis, 360, 1883; JORDAN & DAVIS, *l. c.*, 646.

### 594. NEOCONGER VERMIFORMIS, Gilbert.

Pectoral well developed, 3½ to 4 in head. Snout anteriorly short, slightly projecting beyond mouth; mouth small, reaching slightly behind eye; teeth small, conical, uniserial in jaws, biserial anteriorly on the vomer, uniserial posteriorly; gill slits vertical, longer than eye, a little longer than isthmus; dorsal beginning half length of head in advance of vent; body not very slender, its depth 2½ in head; head 3⅕ in trunk; cleft of mouth 3½ in head; tail usually a little longer than rest of body; tip of tongue slightly free. Color uniform yellowish olive on body and fins, finely dotted with black. Lower California and Panama, in about 30 fathoms; several specimens known. Length 6 inches (*vermis*, worm; *forma*, shape.)

*Neoconger vermiformis*, GILBERT, Proc. U. S. Nat. Mus., 1890, 57, off Lower California, Albatross Station 3035; (Coll. Gilbert); JORDAN & DAVIS, *l. c.*, 646.

## 162. LEPTOCONGER, Poey.

*Leptoconger*, POEY, Anales Hist. Nat. Esp., 250, 1880, (*perlongus*).

This genus differs from *Neoconger* in the much slenderer form, the body being whip-shaped as in *Stilbiscus*. Dorsal beginning between gill opening and vent. (*λεπτός*, slender; *Conger*.)

### 595. LEPTOCONGER PERLONGUS (Poey).

Head 4 in trunk; tail about a third longer than rest of body; gape 4 in head; eye large, 1¾ in snout; snout pointed; teeth hooked, short and robust, subequal and uniserial, a few in front enlarged; lower jaw much shorter than upper; dorsal beginning just behind tip of pectoral. Violet brown, pale below; dark points over the entire surface. (Poey.) Matanzas, Cuba; one specimen known. (*perlongus*, very long.)

*Neoconger perlongus*, Poey, Ann. Lyc. Nat. Hist. N. Y., 67, pl. 9, fig. 3–4, 1874, Matanzas.
*Leptoconger perlongus*, Poey, Ann. Hist. Nat. Esp., 250, 1880; Jordan & Davis, *l. c.*, 644.

## 163. STILBISCUS, Jordan & Bollman.

*Stilbiscus*, Jordan & Bollman, Proc. U. S. Nat. Mus., 1888, 549, (*edwardsi*).

Body whip-shaped, with the tail very short; teeth uniserial, some of the anterior canine. Fins low, the dorsal beginning behind vent. One species known. (*στίλβω*, to shine.)

### 596. STILBISCUS EDWARDSI, Jordan & Bollman.

Head 7½ in trunk, 4½ in tail; snout 7 in head, its length somewhat greater than distance between gill openings; eye 1⅘ in snout, 1½ in interorbital space; cleft of mouth reaching to posterior margin of eye; upper jaw 5 in head; height of gill opening 1½ in snout; teeth all uniserial, some of the anterior enlarged, canine-like; dorsal beginning $1\frac{2}{7}$ length of head behind vent; length of first part about equal to head and pectoral; developed part of dorsal at tail contained 1⅔ times in the head; pectoral 6 in head. Upper part of head and body above lateral line brown; lower parts bright metallic-bluish silvery; dorsal and anal pale, the latter with a dusky stripe on each side of its base; pectorals dusky; caudal black. Green Turtle Cay, one of the Bahamas. One specimen known. (Named for Dr. Charles Lincoln Edwards, of the University of Cincinnati.)

*Stilbiscus edwardsi*, Jordan & Bollman, Proc. U. S. Nat. Mus., 1888, 549, Green Turtle Cay, Bahamas. (Coll. Edwards.)

## 164. GORDIICHTHYS, Jordan & Davis.

*Gordiichthys*, Jordan & Davis, Prelim. Review Apodal Fishes, 644, 1892, (*irretitus*).

Body whip-shaped, excessively long and slender; tail very short; vertical fins low, the dorsal beginning close behind the nape. Teeth uniserial, unequal, some of them canine-like. One species known. (Gordius, the horsehair worm, from *Γόρδιος*, the king whose complicated knot was cut by Alexander; *ἰχθύς*, fish.)

### 597. GORDIICHTHYS IRRETITUS, Jordan & Davis.

Dorsal fin beginning before the gill opening, not far behind the nape; trunk very long; tail 1⅘ in rest of body; head about 16 in trunk (15 to 18, the type being so injured that the gill openings can not be made out); greatest depth of body 40 to 50 times in length of body; upper jaw much the longer, arched, the eye behind its middle; eye moderate, 2½ in snout, 4½ in gape; lower jaw with one row of about 10 stoutish, recurved teeth on each side, those in front enlarged and canine-like; upper jaw with a series of similar teeth on each side and another down middle of vomer, these three series converging forward and meeting at a point opposite middle of lower jaw; in front of this on premaxillary and nasal bones about 4 large, stout, hooked canines, the largest teeth of all; 123 vertebræ in trunk (probably about 100 in tail); pectoral, gill opening, and skin wholly digested in the type; coloration probably similar to *Stilbiscus edwardsi.* Length 2½ feet. Snapper Banks of West Florida, in rather deep water, known from half digested specimens and fragments found in stomachs of other fishes. (*irretitus*, entangled.)

*Gordiichthys irretitus*, Jordan & Davis, Apodal Fishes, 644, 1892, off Pensacola, Florida. (Coll. Stearns.)

## Family XLIX. NETTASTOMIDÆ.

### (The Sorcerers.)

Eels without pectoral fins, with the tongue not free, the posterior nostrils remote from the lip, the gill openings small, separate, and subinferior, the vent remote from the head, the tail ending in a slender tip or filament, the dorsal and anal fins moderately developed, and the jaws produced, slender, and straight, the upper the longer, and both, as also the vomer, armed with bands of sharp, close-set, recurved, subequal teeth. This family contains a few species of deep-sea eels, closely allied to the *Murænesocidæ* in technical characters, but more resembling the *Nemichthyidæ* in appearance, form of the head, and in dentition. Three genera are known—deep-sea fishes, with fragile bodies and the thin skin charged with black pigment. (*Murænidæ*, part, Günther, Cat., viii, 48, 1870.)

- *a.* Dorsal fin low, beginning nearly above gill opening.
  - *b.* Nostrils lateral, the posterior slit-like, placed just in front of eye; snout without fleshy tip. Chlopsis, 165.
  - *bb.* Nostrils nearly superior, the posterior above and in front of eye, the anterior at tip of bony portion of snout; head with numerous mucous pores.
    - *c.* Snout with a long, slender, fleshy tip or proboscis, at the base of which are the anterior nostrils. Venefica, 166.

## 165. CHLOPSIS, Rafinesque.

*Chlopsis*, Rafinesque, Indice Ittiol. Sicil, 58, 1810, (*bicolor*).
*Saurenchelys*, Peters, Berliner Monatsberichte, 1864, 397, (*cancrivora*).

This genus, sufficiently characterized above, is very close to *Nettastoma*, differing chiefly in the position of the nostrils. Two species known, in rather deep water. (*χλόη*, a twig; *ὄψις*, appearance.)

### 598. CHLOPSIS EQUATORIALIS, Gilbert.

Head, 2⅔ in head and trunk; eye 3½ in snout; body extremely slender, tapering posteriorly to a very narrow tail, which is, however, not filamentous; head long and slender, lower jaw shorter than the upper; eye nearly over angle of mouth; posterior nostril a long horizontal slit immediately in front of lower margin of eye; series of slit-like mucous pores along upper jaw; series of round pores along lower jaw; transverse series on occiput; both jaws and vomer with wide bands of short, sharp, conical teeth, inner series on jaws slightly longer than the other; bands on shaft of vomer reaching back to front of posterior nostril; gill openings with their margins much curved, forming ⅘ of a circle, their vertical diameter nearly equal to that of eye, and more than twice the length of the interspace; gape 2⅗ in head; body 3¼ in tail; dorsal beginning 1½ length of head behind the same. Color dusky olive, dotted with coarse brown specks everywhere except on under side of head and fins; blackish streak on median line of belly; fins translucent. (Gilbert.) Coast of Ecuador, at *Albatross* station 2792, in 401 fathoms. (*Æquator*, *Ecuador*, *Equator*, the great circle of latitude of the earth.)

*Chlopsis equatorialis*, GILBERT, Proc. U. S. Nat. Mus., 1891, 347, off Coast of Ecuador, Lat. 1° S., Long. 81° W. (Coll. Albatross.)

## 166. VENEFICA, Jordan & Davis.

*Venefica*, JORDAN & DAVIS, Apodal Fishes, 651, 1892, (*procerum*).

This genus sufficiently described above, differs from the European genus *Nettastoma*, only in the presence of a fleshy proboscis on the tip of the snout. Two species known. (*Venefica*, sorceress, from the name Sorcière, used at Nice for *Nettastoma melanurum*.)

### 599. VENEFICA PROCERA, Goode & Bean.

Body very elongate, compressed, tapering to a very slender attenuate point; its greatest height contained nearly 4 times in distance from gill opening to tip of lower jaw, and equals half length of snout. Head slender, conical; jaws somewhat depressed; upper jaw heavier and thicker, and projecting beyond the lower a distance equal to eye. Length of snout equal to distance from posterior margin of orbit to gill opening; cleft of mouth extending behind eye a distance equal to orbit. On each side of upper jaw, and in advance of eye, are twelve pores; behind each eye are three pores, while on median line, on top of upper jaw are several pores posteriorly arranged in pairs, of which there are four, the ultimate pair being between the posterior nostrils. A pair of pores upon nape, connecting postorbital rows, and seventeen on each side of mandible. Mandibular series continued by another series extending over cheeks and nape. Snout with a slender, filamentous tip, whose length is equal to twice eye. Tongue apparently absent. Teeth arranged as in *Nettastoma melanurum*, but exceedingly small. Dorsal fin commencing above gill opening. Anal inserted at a distance from snout equal to 3⅔ times length of head. Tail twice as long as rest of body. Lateral line highly specialized, with numerous pores, corresponding in general character to those upon the head, and arranged in a deep furrow, their distances apart being about the same as in the case of those upon the head. Height of dorsal and anal fins about equal to half the height of body. Color, apparently, brownish; peritoneum black. Types, two fishes obtained at station 325, N. lat. 33° 35′ 20″, W. long. 76°, at a depth of 647 fathoms. Another mutilated specimen, about 190 millimeters long, taken at station 327. This species is in many respects closely allied to *Nettastoma melanurum* of the Mediterranean, but appears to differ from it in the greater length of the tail, the much smaller teeth, and in the presence of a filamentous nasal tip. Length 30 inches. (Goode & Bean.) Also taken off San Pedro, California. (Gilbert. Albatross Coll.) (*procerus*, tall or long.)

*Nettastoma procerum*, GOODE & BEAN, Bull. Mus. Comp. Zoöl., x, 1883, 224, Gulf Stream.
*Venefica procera*, JORDAN & DAVIS, Apodal Fishes, 652; GOODE & BEAN, Oceanic Ichth., 149, 1895.

## Family L. NEMICHTHYIDÆ.

### (THE SNIPE EELS.)

Body excessively slender, not strongly compressed, deepest near the middle, tapering backward to the tail, which usually ends in a long and slender filament, and forward to a very long and slender neck, which is abruptly enlarged at the occipital region. No scales. Lateral line represented by one or more rows of pores. Head resembling that of *Tylosurus*, the head proper small, short, and rather broad, with flat top and vertical sides. Nostrils large, close together in front of the eye, without tube or flap; jaws excessively prolonged, almost needle-like, the upper the longer and somewhat recurved. Teeth in both jaws small, very numerous, close-set, retrorse. Gill openings rather large, running downward and forward, separated by a narrow isthmus or partly confluent. Pectorals well developed. Anal fin beginning near the vent, higher than the dorsal, becoming obsolete on the caudal filament. Dorsal beginning close behind occiput, its anterior rays soft, succeeded by a long series of very low, simple, spine-like rays, which are slightly connected by membrane, their height rather less than the length of the interspaces; on the tail these spines again give place to soft rays. The soft rays of the fins are connected by thin membrane instead of being imbedded in thick skin, as in eels generally. Color translucent, the lower parts dark, the back pale. Stomach not distensible. Muscular and osseous systems well developed. Abdominal cavity extending far behind the vent. Genera 6, species about 10; singular inhabitants of the deep seas. The species are little known and their anatomy has not been studied. They are certainly eels, and their nearest relations seem to be with the *Nettastomidæ*. The truncate tail of some specimens is probably a result of mutilation. (*Murænidæ*, group, *Nemichthyina*, GÜNTHER, Cat., VIII, 21, 1870.)

*a.* Gill openings partly confluent, rather large; vomerine teeth conspicuously enlarged.

*b.* Vomerine teeth lancet-shaped, very close set; jaws moderate, the snout not longer than rest of head; vent at a distance behind head about equal to postorbital part of head; eye above angle of mouth. SERRIVOMER, 167.

*bb.* Vomerine teeth conical; jaws very long, attenuate; color silvery. SPINIVOMER, 168.

*aa.* Gill openings distinctly separate; vomerine teeth moderate; jaws excessively attenuate, the upper longer and recurved; tail probably always normally with a filiform tip; (truncate in injured specimens; short and band-like in translucent larvæ).

*c.* Vent remote from the head, at a distance behind pectoral more than 3 times length of that fin; color black.

*d.* Gill slits lateral, vertical, well separated; dorsal commencing above pectorals; tail filamentous; jaws long and slender; a single series of pores along lateral line. AVOCETTINA, 169.

*cc.* Vent at the throat, at a distance behind the head less than length of pectoral; anal fin beginning below middle of pectorals; body very long and slender, most of the dorsal rays very slender, nearly free, appearing like slender spines; jaws very slender, not expanded at tip.

*e.* One row of pores along lateral line; tail truncate, (doubtless mutilated); color black. LABICHTHYS, 170.

*ee.* Three rows of pores along lateral line; color dusky silvery, darker below; tail always ending in a long filament. NEMICHTHYS, 171.

## 167. SERRIVOMER, Gill & Ryder.

*Serrivomer*, GILL & RYDER, Proc. U. S. Nat. Mus., 1883, 260, (*beanii*).

*Nemichthyids* with the head behind eyes of an elongated parallelogramic form, with moderately attenuated jaws; branchiostegal membrane confluent at posterior margin, but with the branchial aperture limited by an isthmus except at the margin, and with lancet-shaped vomerine teeth in a crowded (sometimes doubled) row. (*serra*, saw: *vomer*, vomer.)

### 600. SERRIVOMER BEANII, Gill & Ryder.

Stoutest of the family, with much shorter jaws than any other, and with a very formidable vomerine armature; depth of head at vertical from mandibular articulation contained 37 times in the total length; greatest height 29⅘ in total length. (Gill & Ryder) Gulf Stream. (Lat. 41° 40′ 30″, long. 65° 28′ 30″, at 855 fathoms.) Also taken by Dr. Gilbert in the Gulf of California. (Named for Tarleton Hoffman Bean.)

*Serrivomer beanii*, GILL & RYDER, Proc. U. S. Nat. Mus., 1883, 261, Gulf Stream; JORDAN & DAVIS, *l. c.*, 653. (Type, No. 33383. Coll. Albatross.)

## 168. SPINIVOMER, Gill & Ryder.

*Spinivomer*, GILL & RYDER, Proc. U. S. Nat. Mus., 1883, 261, (*goodei*).

*Nemichthyids* with a rectilinear occipitorostral outline, with very attenuated jaws, high mandibular rami, the branchial aperture nearly confluent; enlarged acute conic teeth in a median row on the vomer, and with a silvery epidermis and filiform tail. (*spina*, spine; *vomer*, vomer.)

### 601. SPINIVOMER GOODEI, Gill & Ryder.

Silvery; recognizable also from its smaller eye and deeper mandibles; greatest height of body at the branchial regions contained 52 times in total length; rays ensheathed in a tough membrane. (Gill & Ryder.) Gulf Stream. (Lat. 38° 19′ 26″, long. 68° 20′ 20″, at 2,361 fathoms.) (Named for George Brown Good.)

*Spinivomer goodei*, GILL & RYDER, Proc. U. S. Nat. Mus., 1883, 261, Gulf Stream; JORDAN & DAVIS, *l. c.*, 654. (Type, No. 33293. Coll. Albatross.)

## 169. AVOCETTINA, Jordan & Davis.

*Avocettina*, JORDAN & DAVIS, Apodal Fishes, 655, 1892, (*infans*).

This genus is closely allied to *Nemichthys*, but differs notably in the position of the vent. Lateral line with one series of pores. (*Avocetta*, the avocet, *Recurvirostra*, from the form of the bill.)

### 602. AVOCETTINA INFANS (Günther).

Eye rather large, contained 2 to 3 times in the distance between eye and pectoral; jaws long and filamentous, upper jaw 4 times the length of postorbital part of head; both jaws covered with very fine recurved teeth; pectoral fin about as long as the head is high; gill openings a little less than eye; postorbital part of head contained about 4 times in trunk; dorsal beginning over pectorals, consisting of very delicate rays; trunk contained at least 12 times in tail; greatest depth of body about equal to head without snout. Lateral line with one series of conspicuous pores. Color uniform black, jaws lighter. Deep sea; known from West Indies, mid-Atlantic, off Pernambuco. Also from Alaska, the present description from a specimen taken by Dr. Gilbert off the coast of Alaska, apparently referable to *A. gilli*, but agreeing with Günther's figure of *A. infans*. (*infans*, immature.)

*Nemichthys infans*,* GÜNTHER, Ann. and Mag. Nat. Hist., 1878, 24, and in Voyage Challenger, XXII, 264, 1887, mid-Atlantic, 2,500 fathoms.

? *Labichthys*† *gilli*, BEAN, Proc. U. S. Nat. Mus., 1890, 45, east of Prince of Wales Island, Alaska. (Type, No. 44239. Coll. Albatross.)

*Avocettina infans*, JORDAN & DAVIS, *l. c.*, 655.

## 170. LABICHTHYS, Gill & Ryder.

*Labichthys*, GILL & RYDER, Proc. U. S. Nat. Mus., 1883, 261, (*carinatus*).

According to Goode & Bean the scantily described genus *Labichthys* is identical with *Avocettina*.‡ The following is the original diagnosis:

Nemichthyids with the head behind the eyes, contracted, with very attenuated jaws, the branchiostegal membrane connected to the throat, and the branchial apertures limited to the sides; with small, conical teeth in a band along the vomer, and otherwise dentition of *Nemichthys*; a black epidermis, and the tail abruptly truncated. (Gill & Ryder.) (*λαβή*, grip or hold, correlated with *λαβίς*, forceps; *ἰχθύς*, fish.)

*a.* Ridges bounding the median rostral groove converging backward in a median keel. CARINATUS, 603.

*aa.* Ridges bounding the median rostral groove not confluent backward in a keel. ELONGATUS, 604.

### 603. LABICHTHYS CARINATUS, Gill & Ryder.

The ridges that bound the median rostral groove converging and forming a carina along the median line in vertical from the anterior border of the orbit; greatest height 34⅓ in total length. Color black. (Gill & Ryder.) Dorsal beginning over base of pectoral; vent close behind the pectorals. (Bean.) Gulf Stream, 41° 13′ N., 65° 33′ W.; a scantily described species, not seen by us. (*carinatus*, keeled.)

*Labichthys carinatus*, GILL & RYDER, Proc. U. S. Nat. Mus., 1883, 253, 255, 261, Gulf Stream; JORDAN & DAVIS, *l. c.*, 656. (Type, No. 33369. Coll. Albatross.)

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* *Nemichthys infans*, GÜNTHER: Body much less elongate and eye much smaller than in *Nemichthys scalopacea*. Vent twice or thrice as distant from root of pectorals as is the latter from eye. Eye of moderate size, its diameter about ⅓ its distance from pectoral fin, and about twice interorbital space. (Günther.)

† *Labichthys gilli*, BEAN: Eye half length of postorbital part of head and ⅔ length of pectoral. Postorbital part of head is ¼ upper jaw and $\frac{3}{11}$ of lower from angle of mouth. Dorsal beginning nearly over end of pectoral. Vent distant from head a space equal to 4 times postorbital part of head. Depth of body equals length of head without snout, $\frac{1}{39}$ of total. Dorsal rays very short; longest anal rays ⅕ length of head. Lateral line of one series of large pores. Color uniform black. Length 18⅓ inches. Type from east of Prince of Wales Island, 55° 20′ N., 136° 20′ W., at 1,569 fathoms. (Bean.) Probably identical with *Avocettina infans*. (Named for Theodore Gill.)

‡ We should accept this view were it not that the type of *Labichthys* is said to have the vent at the throat as in *Nemichthys*. The posterior portion of the vent defines *Avocettina*.

### 604. LABICHTHYS ELONGATUS, Gill & Ryder.

The ridges that bound the rostral groove not confluent backwards in a carinaform extension, but ending in a vertical from the orbit; greatest height of body 36 in a total length. Color black. (Gill & Ryder.) Vent not described. Gulf Stream, Albatross Station 2100, 39° 22′ N., 68° 34′ W. (*elongatus*, elongate.)

*Labichthys elongatus*, GILL & RYDER, Proc. U. S. Nat. Mus., 1883, 262, Gulf Stream; JORDAN & DAVIS, *l. c.*, 656. (Type, No. 33577. Coll. Albatross.)

## 171. NEMICHTHYS, Richardson.

*Nemichthys*, RICHARDSON, Voyage Samarang, 16, 1848, (*scolopaceus*).
*Leptorhynchus*, LOWE, Ann. Mag. Nat. Hist., x, 1852, 54, (*leuchtenbergii*), (preoccupied).
*Belonopsis*, BRANDT, Mém. Ac. St. Petersb., Savans Étrangères, 174, 1854, (*leuchtenbergii*).

Gill openings separate; vomerine teeth moderate; vent at the throat. Body very long and slender, ending in a filamentous tail. Jaws very slender, recurved, not expanded at tip. This genus contains one or two species of long and very slender eels, living in deep water, though perhaps nearer the surface than the members of related genera. (*νῆμα*, thread; *ἰχθύς*, fish.)

*a.* Eye moderate, less than half postorbital part of head; depth of head 7 in its greatest length. SCOLOPACEUS, 605.
*aa.* Eye larger, half length of postorbital part of head; depth of head 9 in its length. AVOCETTA, 606.

### 605. NEMICHTHYS SCOLOPACEUS, Richardson.

(SNIPE EEL.)

Head comparatively stout, its depth one-seventh its greatest length. Eye moderate, less than one-third the length of the head without snout. Length of pectoral fins slightly less than height of the anal, which is less than the height of the body and rather more than greatest depth of head. Pale above, belly and anal fin blackish, the color not abruptly changing, the back somewhat speckled. Length 36 inches. Atlantic Ocean, in deep water; very many specimens taken with the beam trawl off the New England coast and off the Grand Banks. Common about Madeira. (*scolopax*, snipe.)

*Nemichthys scolopacea*, RICHARDSON, Voy. Samarang, 25, 1848, South Atlantic; GÜNTHER, Cat., VIII, 21, 1870; GOODE & BEAN, Bull. Essex Inst., 26, 1879; GOODE, Proc. U. S. Nat. Mus., 1880, 485; GOODE & BEAN, Bull. Mus. Comp. Zoöl., 225, 1883; JORDAN & GILBERT, Synopsis, 366, 1883; GÜNTHER, Voy. Challenger, XXII, 263, 1887.
*Leptorhynchus leuchtenbergii*, LOWE, Mém. Soc. Savans Étrangères, Petersburg, 171, 1854, Madeira.
*Belonopsis leuchtenbergii*, BRANDT, Mém. Soc. Sav. Étr., Petersb., 174, 1854, (with good plate).
*Nemichthys scolopaceus*, JORDAN & DAVIS, *l. c.*, 657.

### 606. NEMICHTHYS AVOCETTA, Jordan & Gilbert.

Head 10; depth 58; depth of anal 64 in length of body. Head slenderer, its depth one-ninth its greatest length. Eye large, one-third the head, without snout. Length of pectoral scarcely greater than height of anal, which is scarcely less than greatest depth of body, and more than greatest depth of head. Translucent; belly with close-set dark spots, its lower edge and anal fin black, the back abruptly white and unspotted. Length 22 inches. Puget Sound, near Seattle. One example known, found swimming at the surface; differing in some slight respects from all Atlantic specimens examined, but very likely not a distinct species. (*avocetta*, the avocet.)

*Nemichthys avocetta*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1880, 409, Harbor of Port Gamble, Puget Sound, near Seattle. (Type, No. 27299. Coll. University of Washington.) JORDAN & GILBERT, Synopsis, 367, 1883; JORDAN & DAVIS, *l. c.*, 657.

## Family LI. MYRIDÆ.

### (THE WORM EELS.)

End of tail surrounded by the confluent vertical fins; the posterior nostril is in, or very near, the upper lip, and the tongue is more or less fully adnate to the floor of the mouth. The species are usually of small size and plain colors, more or less worm-like in form, and inhabit sandy coasts in tropical seas. The genera have but few species each. They are intermediate in character between the *Ophichthyidæ* and the *Murænesocidæ*. The osteology has not yet been carefully studied, but they will probably be found to be most nearly related to the latter family, if indeed the two should not be, as in Bleeker's arrangement, reunited with the *Leptocephalidæ*. (*Murænidæ*, *Myrina*, Günther, Cat., VIII, 49–53, 1870.)

*a.* Body elongate, subterete; pectorals present, sometimes minute; anterior nostril tubular; dorsal fin beginning behind head; teeth small.
  *b.* Dorsal fin beginning behind vent; no teeth on vomer; teeth mostly uniserial; body slender, terete. AHLIA, 172.
  *bb.* Dorsal fin beginning before the vent; vomer with teeth.
    *c.* Dorsal beginning at a point about midway between gill opening and vent; pectorals very small; teeth subequal; body slender, terete; the tail much longer than rest of body. MYROPHIS, 173.
*aa.* Body short, much compressed; pectorals almost invisible; mouth narrow; vomerine teeth none; snout obtuse, depressed; vertical fins well developed, the dorsal beginning behind the gill opening. CHILORHINUS, 174.

## 172. AHLIA, Jordan & Davis.

*Ahlia*, JORDAN & DAVIS, Apodal Fishes, 639, 1892, (*egmontis*).

This genus differs from *Myrophis* in the posterior insertion of the dorsal and in the absence of vomerine teeth. (Named for Jonas Nicolas Ahl, of Upsala, whose thesis "De Muræna et Ophichtho," "modestly offered" for the consideration of President Thunberg in 1789, furnishes the beginning of our systematic arrangement of the eels.)

### 607. AHLIA EGMONTIS (Jordan).

Head small, slender, moderately pointed; anterior nostril in a short tube; posterior large, labial directly behind it; cleft of mouth rather short, extending to beyond the rather large eye, which is more than half length of snout; cleft of mouth $3\frac{1}{6}$ in head; teeth on both jaws subequal, pointed, slightly compressed, arranged in single series, those of both jaws directed somewhat backward; the lower teeth larger and more oblique than the upper; about 4 small fixed canines in front of upper jaw; no teeth on vomer in two specimens examined; tongue not free; lower jaw considerably shorter than upper, its edge considerably curved, concave in outline. Nape somewhat elevated; top of head with large pores. Head 5⅓ in distance from snout to vent; head and trunk a little shorter than tail; body slender, its greatest depth a little more than length of gape. Pectoral short and broad, slightly longer than snout; the gill opening short, oblique, extending downward and backward from near middle of base of pectoral. Dorsal fin beginning behind vent, at a distance about equal to length of gape; the fin very low in front, becoming gradually higher towards the tip of tail; anal low, but well developed, considerably higher than dorsal, highest anteriorly, uniting with the dorsal around the tail. Dark brown, apparently uniform, somewhat paler below. Length 15 inches. Egmont Key, Florida. One specimen known.

*Myrophis egmontis*, JORDAN, Proc. Ac. Nat. Sci. Phila., 1884, 44, Egmont Key, Florida. (Type, No. 35086. Coll. Jordan.)

*Ahlia egmontis*, JORDAN & DAVIS, *l. c.*, 639.

## 173. MYROPHIS, Lütken.

*Myrophis*, LÜTKEN, Vidensk. Meddel. Nat. Foren. Kjöbenhavn, 1, 1851, (*punctatus*).

Boby slender, subterete. Pectoral fins small, but present; vertical fins low, surrounding the tail; dorsal beginning before the vent. Vomerine teeth anteriorly in two or three series. Three species of small eels, resembling earthworms, found on the sandy shores of tropical America. (*μῦρος*, Myrus, a genus of eels; *ὄφις*, snake.)

*a.* Base of pectoral half width of gill opening; snout very narrow. PUNCTATUS, 608.

*aa.* Base of pectoral as wide as gill opening; snout almost as broad as long. VAFER, 609.

### 608. MYROPHIS PUNCTATUS, Lütken.

Base of pectoral fin half width of gill opening; snout very narrow; jaws weak; width of snout between the anterior nostrils less than diameter of eye; width of interorbital space equal to eye; greatest width of head less than that of body behind the gill openings; teeth uniserial on vomer and mandible, biserial on maxillary; head 3 times in trunk, 7 times in the tail; depth of body at gill openings 2¾ in head; eye 2 in snout, which is 6 in head; gape 3½ in head; upper jaw projecting. General color light brown, the sides and back punctate with dark brown dots; belly and throat plain, except a little patch of dusky points below the gill openings. West Indian Fauna; coast of Texas to Surinam; common along our Gulf Coast; resembling an earthworm and scarcely larger. (*punctatus*, speckled.)

*Myrophis punctatus*, LÜTKEN, Vid. Med. Naturh. Foren. Kjöben., 1, 1851, West Indies; JORDAN, Proc. Ac. Nat. Sci. Phila., 1883, 282; JORDAN, Proc. U. S. Nat. Mus., 1884, 33; JORDAN & DAVIS, *l. c.*, 640.

*Myrophis longicollis*, KAUP, Apodes, 30, 1856, (not *Muræna longicollis* CUVIER, which is *Echelus myrus*).

*Myrophis microstigmius*, POEY, Repertorio, II, 250, 1867, Cuba; JORDAN & GILBERT, Synopsis, 900, 1883.

*Myrophis lumbricus*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 261, Galveston, Texas. (Type, No. 30896. Coll. Jordan.) JORDAN & GILBERT, Synopsis, 899, 1883.

#### 609. MYROPHIS VAFER, Jordan & Gilbert.

Base of pectoral fin as wide as the gill opening; snout almost as broad as long; width at the nostrils greater than the interorbital width; dorsal commencing nearer the vent than the gill openings; teeth uniserial on vomer and mandible, biserial on maxillary; head a little less than 3 in the trunk, 5½ in the tail; depth of body at the gill openings 3½ to 4 in head; upper jaw projecting. Color light brown; sides and back with minute brown specks, smaller than in *punctatus*; belly and throat plain. Pacific Coast of Tropical America, from Guaymas to Panama; common. Similar to *M. punctatus*, but the pectorals longer. (*vafer*, sly.)

*Myrophis vafer*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 645, Panama. (Type, No. 29681. Coll. Gilbert.) Jordan, Proc. U. S. Nat. Mus., 1885, 370; Jordan & Davis, *l. c.*, 641.

### 174. CHILORHINUS, Lütken.

*Chilorhinus*, Lütken, Vidensk. Meddel. Naturg. Foren. Kjöbenhavn, 1, 1851, (*suensonii*).

Body short, much compressed; mouth narrow; no teeth on vomer; snout depressed, obtuse; pectoral fins very small; vertical fins well developed, the dorsal commencing behind the gill opening. One species known. (*χεῖλος*, lip; *ῥίν*, nostril.)

#### 610. CHILORHINUS SUENSONII, Lütken.

Head and trunk forming ⅖ of the total length; dorsal fin commencing at a point half way between vent and snout; depth 9 times in the total length; eye 2½ in interorbital width, the latter equaling the muzzle; teeth on palatines biserial; ten teeth in two transverse rows on the nasals; teeth on lower jaw triserial. Color uniform dark brown; throat paler; fins darker margined. (Cope.) St. Croix, West Indies, not known elsewhere. (A personal name.)

*Chilorhinus suensonii*, Lütken, Vid. Med. Naturg. Foren., 1, 1851, St. Croix; Günther, Cat., VIII, 52, 1870; Cope, Trans. Amer. Phil. Soc., 1870, 482; Jordan & Davis, *l. c.*, 639.

## Family LII. OPHICHTHYIDÆ.

### (The Snake Eels.)

This family includes those Enchelycephalous eels which are scaleless, and have the end of the tail projecting beyond the dorsal and anal fins, and without the rudiment of a caudal fin. Anterior nostrils placed in the upper lip, opening downwards; gill openings not confluent; tongue more or less fully adnate to the floor of the mouth. The species are, for the most part, moderate or small in size, and they are very abundant in the tropical seas, especially about the coral reefs. The eggs are numerous, of moderate size, similar to those of ordinary fishes. Genera about 12. Species nearly 100. Most of the known genera are found in America, but less than half the species. Many of the species are singularly colored, the bands or spots heightening the analogy between them and the serpents. (*Murænidæ*, part *Ophichthyina*, Günther, Cat., VIII, 54–90, 1870.)

*a.* Body without traces of fins anywhere; teeth all small, conical; gill openings near together, subinferior; anterior nostril tubular; tongue scarcely free in front; mouth small.
  *b.* Gill-slits inferior, converging forward. Sphagebranchus, 175.
  *bb.* Gill-slits small, lateral, placed vertically. Verma, 176.

*aa.* Body with distinct fins, at least on the back.

*c.* Anal fin wholly wanting ; no pectoral fin ; dorsal fin high, beginning on the head ; gill openings subinferior, converging ; anterior nostrils tubular ; tongue slender, somewhat free in front. LETHARCHUS, 177.

*cc.* Anal fin well developed ; anterior nostril usually in a short tube near tip of snout.

*d.* Teeth blunt, mostly granular or molar ; vomer with teeth ; pectoral fins present, small.

*e.* Dorsal rather high, beginning on the head, before the gill opening. MYRICHTHYS, 178.

*ee.* Dorsal fin beginning behind the gill opening, the fin usually low. PISOODONOPHIS, 179.

*dd.* Teeth all pointed, none of them molar ; vomer with teeth.

*f.* Dorsal fin beginning before nape, on anterior part of head ; pectoral fin small or wanting.

*g.* Pectoral fins wholly wanting ; body compressed, the dorsal fin high. CALLECHELYS, 180.

*gg.* Pectoral fins small, but present ; body elongate, subterete, the dorsal fin moderate. BASCANICHTHYS, 181.

*ff.* Dorsal fin beginning more or less behind gill opening.

*h.* Pectoral fins reduced to a small flap, not longer than eye ; teeth small, mostly uniserial ; gill openings lateral. QUASSIREMUS, 182.

*hh.* Pectoral fins well developed, much longer than eye ; teeth gill-openings usually lateral, sometimes subinferior.

*i.* Snout moderate or short, less than one-fourth head, the jaws not produced into a slender beak (as in the European genus *Ophisurus*).

*j.* Lips not fringed.

*k.* Teeth subequal, with no elongate canines on jaws or vomer. OPHICHTHUS, 183.

*kk.* Teeth unequal, some of them long canines, either on vomer or on sides of one or both jaws ; mouth large, the snout short, and the eyes more or less superior.

*l.* Teeth on vomer small, fixed, in two or three series ; tail a little longer than rest of body. MYSTRIOPHIS, 184.

*ll.* Teeth on vomer a series of about four depressible canines ; tail much shorter than rest of body. SCYTALICHTHYS, 185.

*jj.* Lips with a conspicuous fringe of papillæ ; canines present on jaws and vomer ; jaws rather long, the lower projecting ; head depressed ; eyes superior ; tail shorter than rest of body. BRACHYSOMOPHIS, 186.

## 175. SPHAGEBRANCHUS, Bloch.

*Sphagebranchus*, BLOCH, Ichthyologia, IX, 88, pl. 419, 1795, (*rostratus*).*

*Cæcilia*, LACÉPÈDE, Hist. Nat. Poiss., II, 135, 1800, (*branderiana*=*cœcus*); (not *Cæcilia*, L., a genus of *Batrachia*).

*Apterichthys*, DE LA ROCHE, Ann. Mus., XIII, 325, 1809, (*cœcus*).

*Branderius*, RAFINESQUE, Analyse de la Nature, 1815, 93, (*cœcus*).

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* *Sphagebranchus rostratus*, Bloch, is known only from the original figure and description. According to these the species is allied to *Sphagebranchus selachops*, having similar gill openings, but with the tail scarcely as long as the rest of the body, the head larger, about 2 in body or 5 in total length ; snout very sharp ; eye moderate. According to Bloch, his type came from the East Indies. Schneider (1801) corrects the locality to "rivers of Surinam." We have no means of knowing which record is correct, until the species is found again.

*Ichthyapus*, Brisout de Barneville, Revue Zoölogique, 219, 1847, (*acutirostris*).
*Ophisuraphis*, Kaup, Apodes, 29, 1856, (*gracilis*).

This genus contains several little-known species of small eels remarkable for showing no trace of fins in the adult stage. The snout projects beyond the small mouth, giving a shark-like profile, and the small teeth are mostly uniserial. The gill-slits are inferior and converging. The name *Sphagebranchus* was based on a species which evidently belongs to the genus. It has, therefore, clear priority over *Ichthyapus* and *Apterichthys*. This genus is the most simple in structure among the genera of *Ophichthyidæ*, as *Ophichthus* is probably the most specialized. Its loss of fins is doubtless due to degeneration, but it seems nearer the primitive type than *Brachysomophis* or *Ophichthus*. (σφάξ, throat; βράγχια, gills.)

*a.* Eyes visible. Tail nearly half longer than head and trunk; gill slits inferior, converging.
  *b.* Head 6 times in trunk. ANGUIFORMIS, 611.
  *bb.* Head little more than 4 times in trunk. SELACHOPS, 612.

### 611. SPHAGEBRANCHUS ANGUIFORMIS (Peters).

Eyes externally visible. Tail nearly one-half longer than head and trunk. Head 6 in trunk, 17 in total length. Flesh-colored, with small black spots. (Peters.) Open Atlantic, near the West Indies; a small eel, once taken. (*anguis*, the slow worm; *forma*, form.)

*Ophichthys* (*Sphagebranchus*) *anguiformis*, Peters, Berlin Monatsaber., 1876, 849, Atlantic Ocean, 15° 40′ N., 23° 5′ W.
*Sphagebranchus anguiformis*, Jordan & Davis, *l. c.*, 615,

### 612. SPHAGEBRANCHUS SELACHOPS (Jordan & Gilbert).

Eyes well developed. Tail nearly half longer than head and trunk. Head a little more than 4 times in trunk; tail sharp-pointed; snout sharp; cleft of mouth 2½ to 3 in head; gill slits almost horizontal, converging forwards, as in *S. rostratus*, the isthmus equal to eye, which is 2 in snout. General color light brown, slightly dusky on the back and more dusky along the lateral line; head mottled with dusky spots. Rocks about Cape San Lucas; not rare. (σέλαχος, shark; ὤψ, face.)

*Apterichthys selachops*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 356, Cape San Lucas. (Type, No. 4391. Coll. Xantus.)
*Ichthyapus selachops*, Jordan, Proc. U. S. Nat. Mus., 1885, 369.
*Sphagebranchus selachops*, Jordan & Davis, *l. c.*, 615.

## 176. VERMA, Jordan & Evermann.

*Verma*, Jordan & Evermann, new genus, (*kendalli*).

Body greatly elongate. Anterior nostrils in a short tube; posterior without tube. Teeth on head of vomer in a Λ-shaped patch: none on shaft. Closely allied to *Sphagebranchus*, but differing from that genus in the transverse position of its gill-slits, which are as in the European genus *Cæcula*. (*vermis*, worm.)

*a.* Tail but little longer than head and trunk. Head 7½ in trunk; gill slits small, transverse. KENDALLI, 613.

### 613. VERMA KENDALLI (Gilbert).

Head less than ⅕ of trunk, contained 6¾ in trunk, body 1¼ in tail; snout sharp; cleft of mouth 4 in head; gill slits small, inferior, directly transverse (as in *Cœcula imberbis*), the isthmus very narrow, not as wide as eye, which is 2 in snout; tail sharp-pointed; eye before middle of gape. Coloration plain brownish, speckled. Coast of Florida, in rather deep water. (Named for William C. Kendall, assistant in the U. S. Fish Commission.)

*Sphagebranchus kendalli*, GILBERT, Bull. U. S. Fish Comm., ix, 1889, (1891), 310, off west coast of Florida, 25° 34′ N. 82° 50′ W., in 25 fathoms. (Type, No. 44304. Coll. Kendall.)

## 177. LETHARCHUS, Goode & Bean.

*Letharchus*, GOODE & BEAN, Proc. U. S. Nat. Mus., 1882, 437, (*velifer*).

Anal fin wanting; no pectoral fins; dorsal fin well developed, beginning on the head; gill openings subinferior, converging; anterior nostrils tubular; tongue slender. One species known. (*λήθομαι*, to forget; *ἀρχός*, anus, for anal fin.)

### 614. LETHARCHUS VELIFER, Goode & Bean.

Teeth uniserial on jaws and vomer, small and directed inward and backward; snout long and pointed, projecting ⅔ its length beyond the lower jaw; gill openings subinferior, almost horizontal, equal to lower jaw, three times the breadth of the isthmus; nostrils not prominent, without tube; anterior under the tip of snout; lateral line distinct, extending forward in a curve, ending in a pore on the top of the head, just in front of the beginning of the dorsal fin; head 6½ in trunk; tail pointed, 2½ in total length; cleft of mouth 4 in head; snout 9 in head and twice the diameter of the eye. Plum-colored, head lighter, throat pale; dorsal fin white, edged with a broad band of black. Coast of Florida, in rather deep water. Known only from the Snapper Banks off Pensacola and Tampa. (*velum*, sail; *fero*, I bear.)

*Letharchus velifer*, GOODE & BEAN, Proc. U. S. Nat. Mus., 1882, 437, West Florida. (Type, No. 31458. Coll. Kaiser & Martin.) JORDAN & GILBERT, Synopsis, 896, 1883; JORDAN, Proc. U. S. Nat. Mus., 1884, 33; JORDAN & DAVIS, *l. c.*, 616.

## 178. MYRICHTHYS, Girard.

*Pisoodonophis*, KAUP, Apodes, 15, 1856, (in part; not type, as restricted by BLEEKER, which is *P. cancrivorus*).

*Myrichthys*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 58, (*tigrinus*).

*Ophisurus*, SWAINSON, BLEEKER, etc., (not of LACÉPÈDE, nor of RISSO, nor KAUP, who restrict the name to *O. serpens*).

Teeth mostly blunt and molar; pectoral fins small; dorsal beginning on the head before gill opening; otherwise essentially as in *Ophichthus*. Species numerous, found in most tropical seas. Coloration variegated. (*μῦρος*, Myrus; *ἰχθύς*, fish.)

*a.* Spots on body large, blackish, without pale centers; all of them circular or nearly so; the ground color paler. TIGRINUS, 615.

*aa.* Spots on body large, black, most of them with a distinct pale center, the ground color paler. OCULATUS, 616.

*aaa.* Spots on body large, round, nearly whitish in color, the ground color dark. ACUMINATUS, 617.

### 615. MYRICHTHYS TIGRINUS, Girard.

Head 3½ in trunk, 11 in total length; eye 2½ in snout, situated a little back of middle of gape, which is 3 in head; pectoral measured from top of base, about equal to eye. Coloration brown, with large dark spots, which have not paler centers. Spots on sides of body all circular or nearly so; those on anterior part of head small and numerous; lighter below; belly almost plain; 4 longitudinal rows of round black blotches on each side of body, the two middle series often forming one irregular row, the central row very close to the median and consisting of small spots not much larger than the eye, spots in the uppermost row often running up on the dorsal fin, each dorsal row running forward, terminating in the snout; 8 or 9 spots in each dorsal row from the tip of snout to verrtical from gill opening; a row of 5 or 6 spots from gill opening to above eye; two other rows running diagonally downwards and backwards from eye; 7 or 8 spots on each side of snout; jaw with about a dozen spots on each side; dorsal with dark margin; anal plain. Pacific Coast of Mexico, rather common about Mazatlan, occasionally ranging northward, (Adair Bay, Oregon, Girard. (*tigrinus*, like a tiger, in color.)

*Myrichthys tigrinus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 58, Adair Bay, Oregon; JORDAN & DAVIS, *l. c.*, 618; JORDAN & GILBERT, Synopsis, 360, 1883.

*Ophisurus xysturus*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1881, 346, Mazatlan. (Type, Nos. 28142, 28247, and 29642. Coll. Gilbert.)

*Pisodontophis xysturus*, JORDAN, Bull. U. S. Fish Comm., II, 1882, 106.

### 616. MYRICHTHYS OCULATUS (Kaup).

Eye 2 in snout; snout 6 in head, and 4 in distance from tip of snout to beginning of dorsal fin; cleft of mouth 3½ in head; head 4 in the trunk, and a little more than 8 in the tail. Spots on body large, dark, most of them with a distinct pale center. Body dark gray above, white below; on each side two series of large roundish dark spots, with pale centers, one row lying along the dorsal fin, the other a little below the lateral line; about 35 spots in each row; a large spot in front of dorsal fin; snout with about 5 spots on each side; lower jaw with small dusky spots; dorsal fin with a dusky edge and with faint dusky blotches; anal plain. Tropical Atlantic, Cuba to Surinam and Cape Verde Islands. (*oculatus*, having eye-like markings.)

*Pisoodonophis oculatus*, KAUP, Apodes, 22, 1856, Curaçoa.

*Ophisurus latimaculatus*, POEY, Repertorio, II, 252, pl. 3, fig. 1, 1867, Cuba.

*Ophichthys pardalis*, GÜNTHER, Cat., VIII, 82, 1870; (not *Ophisurus pardalis*, VALENCIENNES).

*Myrichthys oculatus*, JORDAN & DAVIS, *l. c.*, 618.

### 617. MYRICHTHYS ACUMINATUS (Gronow).

Spots on body large, nearly round, and whitish in color; ground color dark brown, pale below; two series of round, whitish blotches on each side of body, about 40 spots in each series; spots somewhat larger and more distinct anteriorly, where their diameter is nearly equal to length of snout; head with irregular, round, whitish spots on each side; dorsal brownish, margined with dusky; other fins pale. Snout 5⅔ in head and twice the diameter of the eye; cleft of mouth 3 in head; head 4 in trunk; head and trunk 1⅗ in tail; dorsal beginning at a point slightly nearer the base of pectorals than eye; pectorals very small, their bases as broad as gill opening. Body extremely elongate, the diameter about ⅛ length of head. West Indies, occasionally northward to Florida Keys. (*acuminatus*, sharp.)

*Muræna acuminata*,* GRONOW, Fishes Brit. Mus., 21, 1854, Insula Div. Eustachii.
*Pisodonophis guttulatus*, KAUP, Apodes, 21, fig. 10, 1856, Martinique.
*Ophisurus longus*, POEY, Repertorio, II, 254, 1867, Cuba.
*Ophichthys pisavarius*, POEY, Anal. Soc. Esp. Hist. Nat., 196, 1875, Cuba.
*Ophichthys acuminatus*, GÜNTHER, Cat., VIII, 83, 1870.
*Pisodonophis longus*, JORDAN & GILBERT, Synopsis, 899, 1883.
*Ophisurus acuminatus*, JORDAN, Cat. Fish N. A., 53, 1885.
*Myrichthys acuminatus*, JORDAN & DAVIS, *l. c.*, 619.

## 179. PISOODONOPHIS, † Kaup.

*Pisoodonophis*, KAUP, Apodal Fishes, 17, 1856, (*boro*); *Pisodontophis*, amended spelling.

Small eels, mostly of the Old World, having the blunt teeth of *Myrichthys* and the backward dorsal of *Ophichthus*. Species slender, plainly colored. (*πίσον*, pea; *ὀδούς*, tooth; *ὄφις*, snake.)

### 618. PISOODONOPHIS CRUENTIFER, Goode & Bean.

Head 4 times in trunk; length of body about two-thirds that of tail. Cleft of the mouth rather wide, one-third head. Snout conical, depressed. Head snake-like, with powerful muscular enlargements of the cheeks and a constriction behind the head somewhat like that of *Derichthys*. Eye moderate, half snout, one-tenth head. Teeth granular, in conspicuous bands, a small oblong patch on premaxillaries and a long band on vomer. Pectoral fin broad, spatulate, about two-sevenths head. Dorsal beginning far behind tip of pectoral, its distance from tip of snout one-seventh of total length. Dorsal and anal fins of moderate height. Color uniform brownish yellow. Length 16 inches. Two specimens (28938), station 1035 of the U. S. Fish Commission steamer *Fish Hawk*, in N. lat. 39° 57′ W., long. 69° 28′, in 120 fathoms. Four others at nearly same region in 245 fathoms.

"The peculiar and savage physiognomy of this fish suggests at once the idea that it is a parasitic boring form, and in confirmation of this we have specimens taken by the fishermen on Jeffrey's Bank, and also another from New Bedford, taken by Mr. J. H. Thompson from the body of a fish. We have occasionally taken the dried and shriveled remains of a fish apparently closely related to this from salted halibut and codfish." (Goode & Bean.)

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*We have referred the nominal species, *longus*, *guttulatus*, and *pisavarius* to the synonymy of *acuminatus*, thinking that the alleged differences are matters of individual variation. *Longus* is said to have, in the center of each pale spot, a yellow speck, surrounded by a dark circle. The others are said to lack this central spot, but it may be that it fades in alcohol. *Longus* is said to have the edge of the dorsal darker than the fin. In *guttulatus* and *pisavarius* it is said to be paler.

†Dr. Günther, (VIII, 78), mentions a half-grown eel from Grenada in the West Indies, which he was unable to separate from *Pisoodonophis boro* (Hamilton), of the East Indies and China. It is possible, however, that this specimen really came from China. In *P. boro* the head is 4 times in the very long trunk; the fins are very low and the color is plain brown.

This species is very different from *Pisoodonophis boro*, and may prove the type of a distinct genus. (*cruentifer*, bearing blood, bloody.)

*Pisodonophis cruentifer*, GOODE & BEAN, Oceanic Ichthyology, 147, fig. 166, 1895, Gulf Stream.

## 180. CALLECHELYS, Kaup.

*Callechelys*, KAUP, Apodes, 28, 1856, (*guichenoti*).

This genus contains one American and three East Indian species, agreeing in the elongate, compressed body, absence of pectoral fins, and anterior insertion of the dorsal. In other respects *Callechelys* is close to *Ophichthus*. (καλός, beautiful; ἔγχελυς, eel.)

### 619. CALLECHELYS MURÆNA, Jordan & Evermann.

Depth of body at gill openings a little more than length of upper jaw, which is 3 in head; head 8 in trunk, about 14 in total length; eye small, 2 in snout, placed over the middle of upper jaw; tip of lower jaw extending a little before the front of eye; gill openings small, inferior, sublongitudinal, the distance between them about half the height of one of them; dorsal fin beginning on the head, at a distance behind the angle of the mouth a little more than half the length of upper jaw. Dark olive, closely mottled and spotted with confluent blotches of darker olive and blackish, the spots more distinct anteriorly, posteriorly confluent, so that the tail is nearly plain dusky; belly scarcely paler, dorsal and anal chiefly blackish with pale margins. Snapper Banks off Pensacola; one specimen known. (*Muræna*, from the general resemblance of the species to a young Moray.)

*Callechelys murænа*, JORDAN & EVERMANN, Proc. U. S. Nat. Mus., 1886, 466, Snapper Banks; JORDAN & DAVIS, *l. c.*, 620. (Type, No. 37996. Coll. Stearns.)

## 181. BASCANICHTHYS, Jordan & Davis.

*Bascanichthys*, JORDAN & DAVIS, Apodal Fishes, 621, 1892, (*bascanium*).

This genus is very close to *Callechelys*, from which it differs in the presence of pectorals, the long subterete body, lower fins and plainer coloration. Three species are known. (*Bascanion*, the black snake; ἰχθύς, fish.)

*a.* Pectoral fin a slender rudiment not longer than eye; head about 8 in trunk.
  *b.* Snout 6 to 7 in head; no distinct spots on body. SCUTICARIS, 620.
  *bb.* Snout 5½ in head; a series of large spots between dorsal and lateral line. - PENINSULÆ, 611.
*aa.* Pectoral fin nearly as long as snout; head about 10 in trunk. BASCANIUM, 622.

### 620. BASCANICHTHYS SCUTICARIS (Goode & Bean).

Pectoral fin a slender rudiment about as long as eye; head moderate; body terete, the trunk a little longer than the tail; teeth short, bluntish, recurved, uniserial in each jaw, biserial on vomer; head 8⅔ to 9⅔ in head and trunk, 8 in tail; snout 6 to 7 in head; eye 2 in snout, a little behind the middle of cleft, which is contained in the head 3⅔ times; lower jaw extending forward to middle of snout; distance from tip of snout to beginning of dorsal a little over 2 in head; gill openings vertical, their length about equal to breadth of isthmus; lateral line curved over the opercular region, the pores distant and well separated. Color brown above, lighter below, front of head more or less mottled ; dorsal and anal fins pale, without dark margins. West coast of Florida; not rare. (*scutica*, a whip.)

*Sphagebranchus scuticaris*, GOODE & BEAN, Proc. U. S. Nat. Mus., 1879, 343, Cedar Key. (Type, No. 23636. Coll. Dr. J. H. Velie.)

*Sphagebranchus teres*, GOODE & BEAN, Proc. U. S. Nat. Mus., 1882, 436, West Florida. (Type, No. 31457. Coll. Kaiser & Martin.)

*Cœcula scuticaris*, JORDAN & GILBERT, Synopsis, 358, 1883.

*Cœcula teres*, JORDAN & GILBERT, Synopsis, 897, 1883.

*Bascanichthys scuticaris*, JORDAN & DAVIS, *l. c.*, 621.

### 621. BASCANICHTHYS PENINSULÆ (Gilbert).

Head small, $3\frac{3}{7}$ in trunk (without head); eye 12 in head; snout $5\frac{1}{2}$ in head, projecting beyond lower jaw for a distance equaling diameter of eye. Cleft of mouth extending beyond eye, its length (from tip of snout) $3\frac{1}{4}$ in head. Anterior nostril in a long tube (near tip of snout), the posterior on inner side of upper lip opposite front of eye. Teeth in double series on all the dentary bones ; those on maxillary, shaft of vomer, and sides of mandible small, bluntly conic ; those on head of vomer and front of mandible much broader though little longer, and also very blunt. Eye very small, slightly less than half snout. Gill openings short, vertical, the length of the slit but one-half of the broad isthmus. Vent much in advance of middle of length, the trunk contained $1\frac{7}{13}$ times in the tail. Dorsal fin beginning well forward on top of head, its origin equidistant between gill slit and front of eye. Tip of tail sharp, free from fins for a distance equaling length of snout. Pectoral developed as a short, deep, membranous flap as wide as gill slit ; its length less than half its width. Delicate rays are visible with the aid of a lens. Color light yellowish, a series of large, round, brownish black spots nearly as wide as interspaces between lateral line and base of dorsal; a second series of similar but much fainter spots alternating with the first below the lateral line ; top and sides of head with similar smaller spots, those on snout the smallest. Lower jaw with dusky mottlings; anal translucent, unmarked. Dorsal with a dusky streak. One specimen $10\frac{1}{2}$ inches long, from La Paz Bay, Gulf of California. (*Peninsulæ*, of the Peninsula.)

*Callechelys peninsulæ*, GILBERT, Proc. U. S. Nat. Mus., 1891, 548, La Paz Bay. (Coll. Gilbert.)

### 622. BASCANICHTHYS BASCANIUM (Jordan).

Dark brown, nearly uniform ; fins a little paler. Body extremely slender, subterete, its greatest depth little more than two-fifths length of head; head short; snout 7 in head; mouth very small, the lower jaw thin, included, not extending to the anterior nostril, which is in a short tube ; teeth short, subconic, bluntish, a little unequal, their points directed backwards ; lower teeth nearly uniserial ; upper teeth uniserial laterally, partly biserial anteriorly ; vomerine teeth forming a rhombic patch. Eye moderate, its length more than half that of snout, its center nearly over middle of upper jaw ; cleft of mouth $3\frac{3}{4}$ in length of head. Gill opening vertical, about as wide as isthmus ; its upper edge on level of upper base of pectoral; pectoral developed, small, a little broader than long, nearly as long as snout; dorsal fin very low, beginning at a point midway between front of eye and gill opening; anal similar to dorsal. Head 11½ in distance from tip of snout to vent; head and trunk a little longer than tail; head 1⅖; trunk 14⅘. Length of type, 31 inches; Egmont Key, Florida; distinguished from *B. scuticaris* by the very short head. One specimen known. (*Bascanion*, the black snake, which the body much resembles, from *βάσκανος*, malignant.)

*Cæcula bascanium*, JORDAN, Proc. Ac. Nat. Sci. Phila., 1884, 43, Egmont Key, Florida.
*Bascanichthys bascanium*, JORDAN & DAVIS, *l. c.*, 621.

## 182. QUASSIREMUS, Jordan & Davis.

*Quassiremus*, JORDAN & DAVIS, Apodal Fishes, 622, 1892, (*evionthas*).

This genus contains two species from the Eastern Pacific, differing from *Ophichthus* only in the rudimentary pectoral fins. (*quassus*, obliterated; *remus*, oar.)

*a.* Body with rather large, yellow spots, each with a black ring, besides black spots of various sizes; pectoral not half as long as eye. NOTHOCHIR, 623.
*aa.* Body everywhere freckled with small black spots; pectorals about as long as eye. EVIONTHAS, 624.

### 623. QUASSIREMUS NOTHOCHIR (Gilbert).

Body marked with rather large yellow spots, each with a black ring, and with black spots and blotches of various sizes. Teeth all uniserial; pectorals represented by a small triangular flap, less than ⅓ the diameter of eye and ¼ the gill slit; head 4⅓ in trunk; head and trunk longer than tail by a distance equal to the length of the snout; cleft of mouth 2¼ in head; snout 4 in head; eye ½ of snout, its anterior margin over middle of cleft of mouth; gill slit vertical, lateral 6½ in head. Middle of back with a series of 12 elliptical yellow spots, their length one-half diameter of eye, each spot surrounded by a black ring, coalescent below with a large elliptical black blotch on middle of sides; head closely covered with spots about the size of the eye, around which are reticulations of light yellow. (Gilbert.) San Josef Island, Gulf of California. (*νόθος*, spurious; *χείρ*, hand.)

*Ophichthys nothochir*, GILBERT, Proc. U. S. Nat. Mus., 1890, 58, San Josef Island, Gulf of California. (Coll. Albatross.)
*Quassiremus nothochir*, JORDAN & DAVIS, *l. c.*, 623.

### 624. QUASSIREMUS EVIONTHAS (Jordan & Bollman).

Pectorals very small, about as long as eye; teeth in jaws uniserial, anterior vomerine teeth biserial; head 4¾ in trunk; snout 4½ in head; eye 2⅔ in snout, much nearer angle of mouth than tip of snout; cleft of mouth 2⅘ in head. Color light olive, the entire body covered with numerous small round or oval black spots separated at intervals by a yellowish ground color; in about fifteen places these spots are larger and darker and tend to form cross bands. Hood Island, Galapagos; one specimen known. (*εὐ*, well; *ἰονθός*, freckled; the word from *ἴονθος*, an eruption preceding the growth of the beard.

*Ophichthus evionthas*, Jordan & Bollman, Proc. U. S. Nat. Mus., 1889, 154, Hood Island, Galapagos Archipelago. (Type, No. 41476. Coll. Albatross.)
*Quassiremus evionthas*, Jordan & Davis, *l. c.*, 623.

## 183. OPHICHTHUS, Thunberg & Ahl.

*Ophichthus*, Thunberg & Ahl, De Muræna et Ophichtho, 1789, (*ophis*).
*Congrus*, Rafinesque, Caratteri, etc., 62, 1810, (*maculatus*).
*Ophisurus*, Swainson, Nat. Hist. Classn. Anim., II, 334, 1839, (*pictus* = *maculatus*). (Not of Lacépède; the type of Lacépède, as restricted by Risso, being *serpens*.)
*Centrurophis*, Kaup, Apodes, 2, 1856, (*spadiceus*).
*Pœcilocephalus*, Kaup, *l. c.*, 5, (*bonapartei*).
*Microdonophis*, Kaup, *l. c.*. 6, (*altipinnis*).
*Cœcilophis*, Kaup, *l. c.*, 6, (*compar*).
*Herpetoichthys*, Kaup, *l. c.*, 7, (*ornatissimus*).
*Elapsopsis*, Kaup, *l. c.*, 9, (*versicolor*).
*Murænopsis*, Kaup, *l. c.*, 11, (*ocellatus*). (The name wrongly accredited to Le Sueur.)
*Scytalophis*, Kaup, *l. c.*, 13, (*magnioculis*).
*Leptorhinophis*, Kaup, *l. c.*, 14, (*gomesii*).
*Cryptopterus*, Kaup, Aale Hamburg, 1859, (*puncticeps*).
*Uranichthys*, Poey, Repertorio, II, 256, 1867, (*havannensis*).
*Oxyodontichthys*, Poey, Anales Soc. Nat. Hist. Esp., 254, 1880, (*macrurus*).
*Ophichthys*, Bleeker, Günther, and of recent authors generally.

This genus contains all the Ophisuroid eels which have sharp teeth, no marked canines, well-developed pectoral fins, and the dorsal inserted behind the head. The species are very numerous in the tropical seas, and many attempts have been made to split the group into smaller genera. Notwithstanding the great differences when extremes are compared, these small genera can not be well defined. (ὄφις, snake; ἰχθύς, fish; hence more correctly written *Ophichthys.*)

*a.* Teeth of upper jaw in 2 or 3 series.
  *b.* Teeth of lower jaw uniserial or nearly so; vomerine teeth in 1 series or slightly biserial in front.
   Cryptopterus, (κρυπτός, concealed; πτερόν, fin):
    *c.* Coloration uniform or nearly so; teeth of lower jaw not quite uniserial; tail half longer than rest of body. PUNCTICEPS, 625.
   Ophichthus:
    *cc.* Coloration not uniform; anterior teeth slightly enlarged; eye rather large, nearly median.
     *d.* Sides of body with large, round, black spots; head with smaller ones; dorsal inserted opposite tip of pectorals. HAVANNENSIS, 626.
     *dd.* Sides of body with large, round, whitish spots; dorsal inserted behind tip of pectorals. RETROPINNIS, 627.
  *bb.* Teeth of lower jaw in 2 to 4 series.
   Murænopsis, (*Muræna;* ὄψις, appearance):
    *e.* Vomerine teeth in one row; anterior teeth of jaws or vomer sometimes enlarged; teeth in both jaws biserial, those of the inner series sometimes small and turned inward.
     *f.* Spots on sides of body large and whitish, never black.
      *g.* Dorsal beginning an eye's diameter behind tip of pectoral. GUTTIFER, 628.
      *gg.* Dorsal beginning over or just before tip of pectoral. OCELLATUS, 629.
     *ff.* Spots on sides of body large and black; tail half longer than rest of body. TRISERIALIS, 630.
   Scytalophis, (σκυτάλη, viper; ὄφις, snake):
    *ee.* Vomerine teeth biserial throughout; teeth in both jaws biserial, subequal; no canines. Color plain brownish.

*h.* Eye large, more than half length of snout.
  *i.* Head rather short, 2½ to 3 in trunk.
    *j.* Pectoral about as long as cleft of mouth, which is 2⅔ in head. GOMESII, 631.
    *jj.* Pectorals longer than cleft of mouth, which is 2½ in head. ZOPHOCHIR, 632.
  *ii.* Head long, 1¾ to 2¼ in trunk; pectoral a little longer than gape. MAGNIOCULIS, 633.
*hh.* Eye small, 2½ in snout: gill openings narrow; anterior nostril with a long tube; pectoral longer than gape. PARILIS, 634.

### Subgenus CRYPTOPTERUS, Kaup.

### 625. OPHICHTHUS PUNCTICEPS (Kaup).

Teeth of upper jaw in 2 or 3 series. Mandibular teeth not quite uniserial, some in front forming a second series; dorsal and anal fins disappearing for some distance before their termination near end of tail; pectoral fin well developed; dorsal fin commencing at a short distance behind end of pectoral; tail ⅗ of total length; eye of moderate size; cleft of mouth of moderate width. Coloration uniform. (Kaup per Günther.) Caribbean Sea, at Puerto Cabello. (*punctus*, speckled; *-ceps*, head.)

*Cryptopterus puncticeps*, Kaup, Aale Hamb. Mus., II, pl. 1, fig. 2, 1859, Puerto Cabello.
*Ophichthys puncticeps*, Günther, Cat., VIII, 60, 1870; Jordan & Davis, *l. c.*, 629.

### Subgenus OPHICHTHUS.

### 626. OPHICHTHUS HAVANNENSIS (Bloch & Schneider).

Teeth of upper jaw in 2 or 3 series; lower teeth uniserial; vomerine teeth nearly or quite uniserial. Sides of body with one or more series of large, round, black spots; brown; head with numerous small dark spots and longitudinal folds; a series of large, round, dark spots along the side, the interspaces as wide as the spots; another series of alternate smaller spots along the back, and another along the sides of abdomen; fins yellowish, dorsal with a series of brown spots along the edge; eye large, looking upwards, 1⅔ in snout; teeth moderate, those in front of upper jaw somewhat canine-like; pectoral fin well developed, its extremity nearly opposite to the origin of the dorsal fin; tail longer than rest of body. West Indies, apparently not common, and not lately taken outside of Cuba. It is possible that this species is the true *Ophichthus ophis*, but this identification is not certain. (*havannensis*, living at Havana.)

? *Serpens marinus maculosus*, Willughby, Hist. Pisc., tab. G 9, 1686, no locality.
? *Muræna ophis*, Linnæus, X, 244, 1758, (after Willughby); (may be identical with *Ophichthus regius*, a St. Helena species, likewise spotted with black).
*Innominado*, Parra, Dif. Piezas Hist. Nat., pl. 37, fig. 2, 1787, Havana.
*Muræna havannensis*, Bloch & Schneider, Syst. Ich., 491, 1801, (after Parra).
? *Ophisurus guttatus*, Cuvier, Règne Animal, 232, 1817, Surinam; (after Bloch, pl. 154).
? *Muræna maculosa*, Cuvier, *l. c.*, Surinam; (after *Ophisurus ophis*, Lacépède, which is based on Bloch, pl. 154).
*Herpetoichthys sulcatus*, Kaup, Apodes, 8, fig. 5, (not 6), 1856, locality unknown.
*Uranichthys brachycephalus*, Poey, Repertorio, II, 257, 1867, Cuba.
*Uranichthys havannensis*, Poey, Repertorio, II, 257, 1866.
*Ophichthys havannensis*, Günther, Cat., VIII, 67, 1870.

### 627. OPHICHTHUS RETROPINNIS (Eigenmann).

Sides of body with round whitish spots between darker areas; color light olivaceous, with about 20 oblong dark blotches along the median line of body and tail, the interspaces between these each a round pale spot about as large as eye. Dorsal inserted 1⅕ length of pectorals behind the tips of pectorals; pectorals 2½ in distance from snout to their base; eye 1⅓ in snout, equal to interorbital space; cleft of mouth 3 in head; head 9 in length; gill opening 5 in head; maxillary biserial; mandibular teeth uniserial; vomer with about 15 teeth. Snapper Banks off Pensacola. Close to *O. ocellatus*, but the dentition different. (*retropinnis*, having backward fins.)

*Ophichthys retropinnis*, EIGENMANN, Proc. U. S. Nat. Mus., 1887, 116, Snapper Banks off Pensacola. (Type, No. 38054. Coll. Stearns.)
*Ophichthus retropinnis*, JORDAN & DAVIS, *l. c.*, 630.

### Subgenus MURÆNOPSIS, Kaup.

### 628. OPHICHTHUS GUTTIFER (Bean & Dresel).

Teeth in both jaws biserial; the teeth of the inner series sometimes small and turned inward. Vomerine teeth in one row; anterior teeth of jaws or vomer sometimes a little enlarged. Dorsal beginning behind the tip of the pectoral, at a distance equal to diameter of eye. Head 2⅔ in trunk, 4⅔ in tail; pectoral fin shorter than in *ocellatus*, 3½ in head; eye 1½ in snout; cleft of mouth 2⅓ in head. Color very much as in *ocellatus*, but paler; rather light brown above, pale below, with about 20 round pale spots along the lateral line; lower jaw and throat rather pale, dusted with brown dots; pectoral pale, with a dusky border; a line of small white spots across the occiput, and a shorter but similar row on each side of head. Snapper Banks off Pensacola, Florida; close to *O. ocellatus*, the dentition the same, the dorsal farther back. (*gutta*, spot; *fero*, I bear.)

*Ophichthys guttifer*, BEAN & DRESEL, Proc. Biol. Soc. Wash., 1882, 100, Snapper Banks; JORDAN, Cat. Fish. N. A., 53, 1885. (Type, No. 32647. Coll. Stearns.)
*Ophichthus guttifer*, JORDAN & DAVIS, *l. c.*, 630.

### 629. OPHICHTHUS OCELLATUS (Le Sueur).

Teeth in both jaws biserial, those in front a little enlarged; vomerine teeth in one row. Dorsal fin beginning over or just before tip of pectoral. Color rather dark brown above, lighter below, with about 20 round whitish spots along the side, averaging more than half diameter of eye; dorsal fin commencing over or a little before tip of pectoral, light-colored, with a narrow dark margin; anal light yellow; a row of small white spots across the top of head, sometimes coalescent into a band, and one or more similar but shorter rows on each side of head; pectoral decidedly dusky; jaws, throat, and chin dusted with brown dots. Vomer with about 15 teeth, the anterior inclined to form a double series; tail ½ a head's length longer than head and trunk; head 2⅚ in trunk; eye 1¾ in snout; snout 5½ in head; cleft of mouth 2½ in head; pectoral 2¾ in head. West Indian Fauna, south to Brazil, north to Pensacola; rather common. (*ocellatus*, with eye-like spots.)

*Murænophis ocellatus*, Le Sueur, Journ. Ac. Nat. Sci. Phila., v, 1825, 108, pl. 4, fig. 3, South America.
*Ophisurus remiger*, Valenciennes, in D'Orbigny Voy. Amér. Mérid., Poiss., pl. 12, fig. 2, 1839.
*Ophichthys ocellatus*, Günther, Cat., viii, 68, 1870; Jordan & Gilbert, Synopsis, 359, 1883.
*Herpetoichthys ocellatus*, Goode & Bean, Proc. U. S. Nat. Mus., 1879, 155.
*Ophichthus ocellatus*, Jordan & Davis, *l. c.*, 630.

### 630. OPHICHTHUS TRISERIALIS (Kaup).

Teeth in both jaws uniserial, the anterior more or less enlarged; vomerine teeth in one row. Body terete, the tail 1½ times the length of head and trunk; head flattish; mouth broad, its width as great as distance between the nostrils or as interorbital space; gill openings vertical, well separated; dorsal fin beginning a little before tip of pectoral; head 2⅔ in trunk, 5½ in tail; pectoral fin 2¾ to 3¼ in head, about equal to lower jaw; cleft of mouth 2⅗ in head; gill openings less than one-half the pectorals, less than eye, 1½ in isthmus; eye 1½ in snout, 2⅔ in cleft of mouth; teeth rather strong, one or two in front of upper jaw almost canine-like; vomerine teeth small. Color light brown: a row of rather large round black blotches above the lateral line; a series of smaller spots on each side of dorsal, alternating with the large blotches; a row of submarginal spots along the dorsal fin; anal fin plain; top and sides of head with smaller spots; in adults a faint, dusky shade across the pectoral; lower parts pale; longitudinal wrinkles on throat conspicuous. Pacific Coast of Tropical America, rather common, from Lower California to the Galapagos. (*triserialis*, three-rowed.)

*Murænopsis triserialis*, Kaup, Apodes, 12, 1856, Pacific.
*Herpetoichthys callisoma*, Abbott, Proc. Ac. Nat. Sci. Phila., 1860, 475, locality unknown.
*Ophisurus californiensis*, Garrett, Proc. Ac. Nat. Sci. Cal., 1863, 66, Coast of Lower California.
*Ophichthus rugifer*, Jordan & Bollman, Proc. U. S. Nat. Mus., 1889, 155, Charles Island, Galapagos; young with longer pectorals. (Type, No. 41428. Coll. Albatross.)
*Ophichthys triserialis*, Günther, Cat., viii, 58, 1870; Streets, Bull. U. S. Nat. Mus., vii, 55, 1877; Jordan & Gilbert, Proc. U. S. Nat. Mus., 1880, 457; Jordan & Gilbert, Synopsis, 359, 1883.
*Ophichthus triserialis*, Jordan & Davis, *l. c.*, 631.

### Subgenus SCYTALOPHIS, Kaup.

### 631. OPHICHTHUS GOMESII (Castelnau).

(Sea Serpent.)

Vomerine teeth biserial throughout; teeth in both jaws biserial, subequal, no canines; pectoral 2⅕ to 2⅗ in head, about as long as cleft of mouth, which is 2⅔ in head. Body terete; the head rather short, about 2⅔ (2½ to 3) in trunk; the head and trunk $1\frac{5}{7}$ (1¼ "*chrysops*" to $1\frac{9}{10}$ "*macrurus*") in the tail; snout rather short, pointed; interorbital space broad, equal to eye, which is about 1½ in snout; nasal tubes short; dorsal inserted behind middle of pectoral; diameter of gill opening equal to eye, 1½ in the isthmus, 3 in the pectoral. Olive brown above, the coloration caused by innumerable brown points on a yellowish ground; light yellow below; pectoral dusky, dark along the upper edge; lower jaw with dusky markings; dorsal and anal fin translucent, with dark margins; pores on jaws and head conspicuous. South Carolina to Rio Janeiro, generally common, especially about the Florida Keys and Cuba. The variations in the length of the trunk and tail have given rise to various nominal species. One of these (*macrurus*, Poey) with the head and trunk 1⅘ to 2⅛ in the tail instead of 1½ to 1⁵⁄₇ as usual in *gomesii* may be a tangible variety, or possibly a species. (Named for Dr. Ildefonso Gomes, who cured Castelnau of a dangerous malady in Rio Janeiro.*)

*Ophisurus gomesii*, CASTELNAU, Anim. Amér. Sud., 84, pl. 44, fig. 2, 1855, Rio Janeiro.
*Ophisurus chrysops*, POEY, Memorias, II, 321, 1867, Havana.
*Oxydontichthys brachyurus*, POEY, Synopsis. 426, 1868; and Poey, Enumeratio, II, 155, 1875, Havana.
*Oxyodontichthys macrurus*, POEY, Anal. Soc. Hist. Nat. Esp., 254, 1880, Havana.
*Oxydontichthys limbatus*, POEY, Anal. Soc. Hist. Nat. Esp., 254, 1880, Havana, (name a substitute for *brachyurus*).
*Ophichthys gomesii*, GÜNTHER, Cat., VIII, 60, 1870.
*Ophichthys chrysops*, JORDAN & GILBERT, Synopsis, 898, 1883.
*Ophichthus gomesi*, JORDAN & DAVIS, *l. c.*, 632.

### 632. OPHICHTHUS ZOPHOCHIR (Jordan & Gilbert).

Dentition as in *O. gomesii*. Pectoral longer, 2 to 2⅕ in head, longer than the cleft of the mouth, which is 2½ in head. Tail very nearly twice as long as rest of body; snout rather long; interorbital space narrow, less than eye; nasal tubes rather long, flattened, the edge uneven; dorsal commencing over or in front of the middle of pectoral; head 2⅓ in trunk; head and trunk a little more than half the tail; pectoral fin 2⅕ in head; eye 1½ in snout, ½ greater than interorbital width; gill opening less than eye, 1¼ in isthmus. Color brown above, light yellow below; opercular regions, lower jaw, throat, and pectoral dusky; dorsal and anal edged with black. Pacific Coast of Mexico, Guaymas to Acapulco; rather common. Close to *O. gomesii*, but the pectoral longer. (ζόφος, darkness; χείρ, hand (pectoral fin).)

*Ophichthys zophochir*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1881, 347, Mazatlan. (Type, Nos. 28280, 28277, 29220, and 29239. Coll. Gilbert.) JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 623.
*Ophichthus zophochir*, JORDAN & DAVIS, *l. c.*, 633.

### 633. OPHICHTHUS MAGNIOCULIS (Kaup).

Dentition of *O. gomesii*, but the head rather long, 1¾ to 2⅕ in trunk. Tail long, about 2⅕ times length of rest of body; pectoral 2⅓ in head; dorsal inserted over middle of pectoral; gape 2⅖ in head; head 1¾ in trunk; eye about 2¾ in snout. Blackish, paler below; dorsal and anal yellowish brown, dotted and bordered with black. West Indies to Brazil, scarce; our specimen from Aspinwall. (*magnus*, great; *oculus*, eye.)

*Scytalophis magnioculis*, KAUP, Apodes, 13, f. 7, 1856, St. Croix; Brazil.
*Ophichthys magnioculis*, GÜNTHER, Cat., VIII, 59, 1870.
*Ophichthus magnioculis*, JORDAN & DAVIS, *l. c.*, 633.

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*Je dédie cette espèce à M. le docteur Ildefonso Gomes, comme un témoignage de ma reconnaissance pour les soins désintéressés qu'il m'a donnés à Rio de Janeiro en concurrence avec mon ami le docteur Weddell, pendant la dangereuse maladie dont j'y fus atteint (Francis de Castelnau).

### 634. OPHICHTHUS PARILIS* (Richardson).

Dentition as in *O. gomesii.* Eye small, about 2⅓ in snout; gill openings not very wide, approaching nearer together than usual in this genus; anterior nostril with an elongate tapering tube; head 2 in trunk; cleft of mouth 2⅔ in head; eye 2½ in snout; pectoral 2¼ in head; dorsal fin rather low, commencing above posterior third of pectoral; tail twice as long as rest of body. Coloration uniform. (Günther.) Cuba to Brazil; not common. (*parilis*, like.)

*Ophisurus parilis*, Richardson, Voyage Erebus & Terror, 105, 1844, West Indies.

*Ophichthys pauciporus*, Poey, Repertorio, II, 255, pl. 3, fig. 5, 1868, Cuba; Günther, Cat., VIII, 60, 1870.

*Ophichthys parilis*, Günther, Cat., VIII, 59, 1870.

*Ophichthus parilis*, Jordan & Davis, *l. c.*, 634.

## 184. MYSTRIOPHIS, Kaup.

*Mystriophis*, Kaup, Apodes, 10, 1856, (*rostellatus*).

*Crotalopsis*, Kaup, Abhandl. Naturwiss. Verein Hamburg, IV, 12, 1860, (*punctifer*).

*Echiopsis*, Kaup, Abhandl. Natur. Verein Hamburg, IV, 13, 1860, (*intertinctus*).

*Macrodonophis*, Poey, Repertorio, II, 251, 1867, (*mordax*).

This genus contains three or four species of black-spotted eels, distinguished from *Ophichthus* by the presence of strong canines in the large mouth. The vomerine teeth, as in *Ophichthus*, are small and fixed. The species differ considerably from each other and all are nearly related to such species of *Ophichthus* as *triserialis* and *havannensis.* The value to be assigned to *Mystriophis* is therefore doubtful. Our species belongs to the subgenus *Echiopsis*, (ἔχις viper; ὄψις, appearance), in which the jaws are narrowed forwards, not expanded at tip. (μυστρίον, a spoon, from the form of the snout in *M. rostellatus*; ὄφις, snake.)

### Subgenus ECHIOPSIS, Kaup.

### 635. MYSTRIOPHIS INTERTINCTUS (Richardson).

Jaws narrow and not expanded at tip. Vomerine teeth small, fixed; in one to three series. Teeth in jaws biserial; long canines in front of jaws; outer teeth of upper jaw unequal, some of them canine; vomerine teeth in two series, these sometimes partly coalescing (sometimes, var. *punctifer*, partly divided into three); lower jaw scarcely included; pectoral fin about 5 in head; tail a little longer than rest of body; dorsal commencing behind tip of pectoral, distance equal to about length of same; isthmus equal to ⅔ the gill openings, which are large, close together, and subinferior, anterior in position; head 2⅓ to 2⅚ in trunk; eye small, 1½ to 2 in snout; gape 2¼ in head; snout 3 in cleft of mouth. 7 in head. Dark brown above, paler below, side with two rows of large round or ovate black spots, the upper row close to the dorsal fin, the lower row below the lateral line; besides these some smaller spots, also black; head a little darker than the body, the spots smaller and numerous, some larger ones below eye; dorsal and anal with dark borders formed by spots; pectoral black at tip, the remainder more or less dusky. West Indian Fauna, north to Pensacola; rather common; variable.* (*inter*, between; *tinctus*, colored.)

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* Possibly two species are included by us under *parilis*. In *parilis* the insertion of the dorsal is before the end of the pectoral; in the type of *pauciporus* the dorsal is said to be inserted behind tip of pectoral; no other differences appear.

*Ophisurus intertinctus*, Richardson, Voy. Erebus & Terror, Fishes, 102, 1844, West Indies.
*Ophisurus sugillatus*, Richardson, Voy. Erebus & Terror, 103, 1844, probably West Indies.
*Crotalopsis punctifer*, Kaup, Abhandl. Wiss. Verein Hamb., iv, 2, 12, pl. 1, fig. 3, 1860, Puerto Cabello.
*Conger mordax*, Poey, Memorias, ii, 319, 1860, Cuba.
*Ophichthys schneideri*, Steindachner, Ich. Beitr., viii, 66, 1879, Brazil.
*Macrodonophis mordax*, Poey, Repertorio, ii, 252, 1868.
*Ophichthys punctifer*, Günther, Cat., 56, 1870.
*Ophichthys intertinctus*, Günther, Cat., viii, 57, 1870; Jordan, Proc. Ac. Nat. Sci. Phila., 1884, 43; Jordan, Cat. Fish. N. A., 53, 1885; Jordan & Davis, *l. c.*, 635.
*Crotalopsis mordax*, Goode & Bean, Proc. U. S. Nat. Mus., 1879, 344.

## 185. SCYTALICHTHYS, Jordan & Davis.

*Scytalichthys*, Jordan & Davis, Apodal Fishes, 635, 1892, (*miurus*).

This genus contains a single species allied to *Mystriophis*, but distinguished by the presence of movable canines on the vomer, and by the very short tail. (*σκυτάλη*, viper; *ἰχθύς*, fish.)

### 636. SCYTALICHTHYS MIURUS (Jordan & Gilbert).

Vomerine teeth in one series of about 4 slender depressible canines; tail very short, much shorter than rest of body. Dorsal fin inserted well behind tip of pectorals; gill opening midway between eye and beginning of dorsal fin; pectoral fin very short, as long as snout, 10 in head; snout short, 4 in cleft of mouth; head depressed and pointed, the mouth large; teeth long, those on vomer and side of lower jaw canine-like; teeth of upper jaw biserial, rather small; lower teeth uniserial; vomerine teeth uniserial; eye small, placed well forward; gill openings small, transverse, inferior, as in *Cœcula imberbis*, the slit as long as snout and wider than isthmus; head $4\frac{3}{5}$ in the very long trunk; tail $1\frac{4}{7}$ in rest of body; cleft of mouth $2\frac{1}{5}$ in head. Coloration light yellowish, a series of roundish dark brown blotches on each side of body, the two series alternating; two alternating series of small half blotches on the back, these coalescing into one on median line before dorsal; head with small, dark spots; sides of lower jaw spotted; fins pale. Length 1 foot. Cape San Lucas; two specimens known. (*μείουρος*, curtailed, from the short tail.)

*Ophichthys miurus*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 357, Cape San Lucas. (Type, No. 2304. Coll. Xantus.)
*Mystriophis miurus*, Jordan & Davis, *l. c.*, 636.

## 186. BRACHYSOMOPHIS, Kaup.

*Brachysomophis*, Kaup, Apodes, 9, 1856, (*horridus*).
?*Achirophichthys*, Bleeker, Poissons Inéd. Murènes, Ned. Tijdschr. Dierk., ii, 42, (*typus* = young).

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* Possibly more than one species is here included. *Schneideri* is said to have the vomerine teeth biserial, while in "*punctifer*" (*mordax*) they are triserial. In the true *intertinctus* the teeth are biserial in front and uniserial behind, while in *sugillatus* the vomerine teeth are said to be uniserial. In *sugillatus*, the pectoral is said to be longer than in *intertinctus*, as long as eye and snout. Our specimens have the teeth biserial or partly triserial in front. Probably all belong to one species. If two species exist they may stand as *intertinctus* and *punctifer*.

This genus differs from *Mystriophis* chiefly in the presence of a conspicuous fringe of papillæ on the lips. The vomerine teeth are canine as in *Scytalichthys*. Species East Indian, one being recorded from the Galapagos. (*βραχύς*, short; *σῶμα*, body; *ὄφις*, snake.)

### 637. BRACHYSOMOPHIS CROCODILINUS (Bennett).

Teeth unequal in size; maxillary teeth in a double row, those of the inner row stronger and less numerous than the outer; vomerine and mandibular teeth uniserial, large canine teeth; head 3 in trunk; snout extremely short and rather flattened, scarcely twice as long as eye, which is small and situated in the anterior ninth of the length of the head; vertical fins moderately well developed; distance between the origin of dorsal fin and gill opening 2½ in head; pectoral small; body longer than tail. Upper parts brownish, minutely dotted with darker; a series of black pores along the lateral line, sometimes a whitish line across the occiput. (Günther.) East Indies, a specimen recorded by Günther from the Galapagos. (*crocodilinus*, like a crocodile.)

*Ophisurus crocodilinus*, BENNETT, Proc. Zoöl. Soc. Lond., 1833, 32, **Mauritius.**
*Brachysomophis horridus*, KAUP, Apodes, 9, fig 6, 1856, **Otaheite.**
? *Achirophichthys typus*, BLEEKER, Ned. Tijdschr. Dierk., 42, **Celebes.**
*Ophichthys crocodilinus*, GÜNTHER, Cat., VII, 64, 1870.
*Brachysomophis crocodilinus*, JORDAN & DAVIS, *l. c.*, 636.

## Suborder COLOCEPHALI.

The characters of this group are given on page 346. Three families are now recognized. (*κόλος*, defective; *κεφαλή*, head.

### Family LIII. MURÆNIDÆ.

### (THE MORAYS.)

The *Murænidæ* represent the most degenerate type of eels so far as the skeleton is concerned, and they are doubtless the farthest removed from the more typical fishes from which the eels have descended. The essential characters of the family are thus stated by Dr. Gill:

Colocephalous Apodals with conic head, fully developed opercular apparatus, long and wide ethmoid, posterior maxillines, pauciserial teeth, roundish, lateral branchial apertures, diversiform vertical fins, pectoral fins (typically) suppressed, scaleless skin, restricted interbranchial slits, and very imperfect branchial skeleton, with the fourth branchial arch modified, strengthened, and supporting pharyngeal jaws.

The Morays may be readily distinguished from the other eels by their small round gill openings and by the absence of pectorals. The body and fins are covered by a thick, leathery skin, the occipital region is elevated through the development of the strong muscles which move the lower jaw, and the jaws are usually narrow and armed with knife-like or else molar teeth. The Morays inhabit tropical and subtropical waters, being especially abundant in crevices about coral reefs. Many of the species reach a large size, and all are voracious and pugnacious. The coloration is usually strongly marked, the color cells being highly specialized. We exclude from the *Murænidæ* the genus *Myroconger*, from St. Helena, which has pectoral fins, and is probably a type of a distinct family. The remaining species are referable to ten or twelve genera, most of which are found in America. About 120 species are known. The *Murænidæ* without fins are the simplest in structure, but their characters are those of degradation, and they are farther from the primitive stock than such genera as *Muræna* or *Enchelycore*.

(*Murænidæ Engyschistæ*, Günther Cat., VIII, 93–136; order *Colocephali*, Cope, Trans. Amer. Phil. Soc., 1870, 456.)

*a.* Vertical fins well developed, the dorsal beginning before the vent.
- *b.* Posterior nostril an oblong slit; anterior in a short tube; teeth all pointed; dorsal beginning above the gill opening; canine teeth strong; tail moderate. Enchelycore, 187.
- *bb.* Posterior nostril circular, with or without tube; tail moderate, not twice as long as trunk; body not excessively elongate.
  - *c.* Teeth all, or nearly all, acute, none of those in the jaws obtuse or molar-like.
    - *d.* Anterior nostrils without tube; vomerine teeth in many series; lips with a free fold. Pythonichthys, 188.
    - *dd.* Anterior nostrils each with a long tube; vomerine teeth in one or two series; lips continuous with skin of head.
      - *e.* Posterior nostrils without tube, the margin sometimes slightly raised.
        - *f.* Dorsal fin inserted behind the head, over or behind the gill opening. Rabula, 189.
        - *ff.* Dorsal fin inserted on the head, considerably before gill opening. Lycodontis, 190.
      - *ee.* Posterior nostrils as well as anterior each in a conspicuous tube. Muræna, 191.
  - *cc.* Teeth mostly obtuse, molar-like; only anterior nostrils tubular; cleft of mouth rather short; dorsal beginning before the gill opening. Echidna, 192.

Vertical fins rudimentary, confined to the end of the tail (often appreciable only on dissection, or altogether wanting); teeth rather small, pointed, subequal, in several series; posterior nostril round, with a short tube, or none.
- *g.* Cleft of the mouth short, not half length of head; snout moderate, about half the gape; tail about as long as trunk. Uropterygius, 193.
- *gg.* Cleft of the mouth long, nearly half head; snout very short, less than one-fourth the gape; tail very short, about half rest of body. Channomuræna, 194.

## 187. ENCHELYCORE, Kaup.

*Enchelycore*, Kaup, Apodes, 72, 1856, (*euryrhina*).

Posterior nostril an oblong slit, otherwise essentially as in *Lycodontis*. One species known. (*ἔγχελυς*, eel; *κόρη*, girl; the application not evident.)

### 638. ENCHELYCORE NIGRICANS (Bonnaterre).

Snout narrow, rather produced, 2⅔ in gape; the jaws cannot be shut in adult examples. Teeth of upper jaw biserial, the inner series of very long and slender depressible canines; long canines not movable in front of each jaw; lateral teeth of lower jaw slender, subequal, sharp, and recurved; vomerine teeth small, uniserial, developed posteriorly; eye moderate, 2 in snout; gape 2 in head; dorsal beginning above the gill opening; tail slightly longer than rest of body; head 3 to 3¼ in trunk. Uniform black or dark brown, sometimes faintly marbled with darker; angle of mouth slightly darker; gill opening pale. West Indies, rather common. (*nigricans*, blackish.)

*Muræna unicolor maxillis elongatus teretiusculis, inferiore longiore*, etc., Gronow, Zoöphy., 1, 163, 1763, South America.

*Muræna nigricans*, Bonnaterre, Encycl. Meth. Ichth., 34, 1788, (after Gronow).
*Muræna anguina*, Gronow, Catalogue Fishes, 18, 1854, South America.
*Enchelycore euryrhina*, Kaup, Apodes, 73, 1856, no locality.
*Gymnothorax nigrocastaneus*, Cope, Trans. Amer. Phil. Soc., 1870, 483, St. Martins.
*Gymnothorax umbrosus*, Poey, Ann. Lyc. Nat. Hist. N. Y., 1874, 67, Havana.
*Enchelycore nigricans*, Günther, Cat., viii, 135, 1870; Jordan & Davis, *l. c.*, 588.

## 188. PYTHONICHTHYS, Poey.

*Pythonichthys*, Poey, Repertorio, ii, 265, 1867, (*sanguineus*).

This genus is based on a single West Indian species, which apparently differs from *Lycodontis* only in the entire absence of nasal tubes. The species is deep red in color, and inhabits deeper water than usual among the Morays. (*πύθων*, a large snake; *ἰχθύς*, fish.)

### 639. PYTHONICHTHYS SANGUINEUS, Poey.

Body terete, slim; the depth contained 40 times in total length; nostrils in a line between eye and tip of snout, about as long as eye; lips full, each with a fold; dorsal commencing a little before gill opening; teeth in jaws biserial; those of upper jaw small and numerous, sharp-pointed; outer row of teeth a little larger and less numerous than inner; inner row of teeth in lower jaw granular; teeth on vomer pluriserial, small; eye very small, 6 in snout, 12 in gape; gape 3 in head; head 2 in trunk; tail 2⅔ times rest of body. Color uniform blood-red. (Poey.) Coast of Cuba, in rather deep water; rare. (*sanguineus*, blood red.)

*Pythonichthys sanguineus*, Poey, Repertorio, ii, 265, pl. 2, fig. 7, 1867, Cuba; Jordan & Davis, *l. c.* 589.
*Muræna sanguinea*, Günther, Cat., viii, 126, 1870.

## 189. RABULA, Jordan & Davis.

*Rabula*, Jordan & Davis, Apodal Fishes, Rept. U. S. Fish Comm., viii, 1888, (1892), 589, (*aquæ-dulcis*).

This genus differs from *Lycodontis* only in the posterior insertion of the dorsal fin, which begins over or behind the gill opening. The five known species have so little in common that the value of the character which separates them from *Lycodontis* is rather uncertain. (*Rabula*, a wrangler.)

*a.* Dorsal fin inserted far back, nearer vent than gill opening. Dark brown, with diffuse yellowish spots and marblings. AQUÆ-DULCIS, 640.
*aa.* Dorsal fin inserted over or slightly behind gill opening.
  *b.* Teeth in both jaws uniserial; color yellowish brown, with dark reticulations and yellow spots. MARMOREA, 641.
  *bb.* Teeth of upper jaw uniserial; tail longer than rest of body; color purplish brown, nearly plain.
    *c.* Jaws with curved commissure, and hence not capable of being completely closed; some of the teeth serrate; head small, bluntish; tail a little longer than rest of body. PANAMENSIS, 642.
    *cc.* Jaws with straightish commissure, and hence capable of being closed; tail half longer than rest of body. LONGICAUDA, 643.

### 640. RABULA AQUÆ-DULCIS (Cope).

Dorsal fin inserted far back, nearer vent than gill opening. Eye moderate, over middle of gape; lower teeth uniserial, with canines in front; upper teeth biserial, the outer teeth small; vomer with strong canines in front, the posterior teeth small, uniserial; posterior nostril nearer eye than anterior one. Insertion of dorsal 1¼ lengths of the head before vent, much nearer vent than gill opening. Tail longer than rest of body by the length of the jaw. Head 3 in trunk; gape 2⅔ in head; eye 2 in snout. Color much as in *Lycodontis mordax*, dark brown with irregular diffuse yellowish spots smaller than eye, which run together into irregular marblings; gill opening small, slightly dark; fins nearly plain; belly without dark cross lines; teeth entire. Two specimens known, the one (No. 6673, U. S. N. M.), said to be from San Diego, the type from Rio Grande in Costa Rica. It is probably not a fresh water species. (*aquæ-dulcis*, of the fresh water.)

*Muræna aquæ-dulcis*, COPE, U. S. Geol. Surv. Montana, etc., 474, 1871, (1872), Rio Grande, near San José, Costa Rica.
*Gymnothorax aquæ-dulcis*, JORDAN & DAVIS, *l. c.*, 598.

### 641. RABULA MARMOREA (Valenciennes).

Dorsal inserted over or slightly behind gill opening. Teeth in upper jaw uniserial; (dorsal fin in figure beginning a short distance behind gill opening). Color yellowish brown with dark reticulations, the longitudinal branching streaks studded with oblong yellow spots; spots on belly large, those on throat confluent; dorsal and anal yellowish brown with darker clouds; teeth all uniserial. (Valenciennes.) Galapagos Islands; a doubtful species, perhaps based on *Muræna lentiginosa*, or *Rabula aquæ-dulcis*. (*marmoreus*, marbled.)

*Murænophis marmoreus*, VALENCIENNES, Voy. Vénus, Zoöl., 347, pl. 10, fig. 1, 1855, Galapagos.
*Gymnothorax marmoreus*, JORDAN & DAVIS, *l. c.*, 598.

### 642. RABULA PANAMENSIS (Steindachner).

Teeth of upper jaw biserial; jaws capable of being completely closed; some of the teeth serrate; outer teeth of jaws thickish, bent abruptly backward at tip, the posterior margin below distinctly serrate; lower jaw strongly bent upward towards the tip, the largest teeth on the bent anterior part of the jaws; teeth of the inner row above long, slender, and movable, twice as large as the outer teeth; teeth of inner row of lower jaw slender (all lost in specimen examined); vomerine teeth small, uniserial, blunt (slender and sharp according to Steindachner); head small, bluntish, 7½ in body; tail a little longer than rest of body; gape 2⅓ in head; eye 1⅓ in snout; dorsal beginning over gill opening. Color dark bluish black, brownish on tail; pores on jaws whitish. Pacific Coast of Central America; a small species, not common; our specimen from Panama.

*Muræna panamensis*, STEINDACHNER, Ichth. Beit., v, 19, 1876, Panama.
*Sidera panamensis*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 623.
*Gymnothorax panamensis*, JORDAN & DAVIS, *l. c.*, 598.

### 643. RABULA LONGICAUDA (Peters).

Teeth of upper jaw biserial; jaws with straightish commissure and hence completely closing; teeth all entire. Tail about half longer than rest of body; dorsal beginning a little behind gill opening; vomerine teeth slender and rather long; teeth in two series in each jaw; those of the inner series largest and movable; anterior canines enlarged; outer teeth of upper jaw bluntish and turned backward as in *R. panamensis*; snout short, bluntish; eye large; head $2\frac{3}{4}$ in trunk, $8\frac{2}{3}$ in total; gape short. Color purplish brown, finely mottled with darker, the markings faint. Tropical Atlantic off the West Indies; two small specimens recorded. (*longus*, long; *cauda*, tail.)

*Muræna longicavda*, PETERS, Berliner Monatsberichte, 1876, 850, Open Atlantic, with *Sphagebranchus anguiformis*.

*Gymnothorax longicauda*, JORDAN & DAVIS, *l. c.*, 599.

## 190. LYCODONTIS, McClelland.

*Lycodontis*, MCCLELLAND, Calcutta Journ.[*] Nat. Hist., v, No. XVIII, 1844, 173, (*literata = tile*).
*Thærondotis*, MCCLELLAND, *l. c.*, v, No. XVIII, 1844, 174, (*reticulata = tessellata*).
*Sidera*, KAUP, Apodes, 70, 1856, (*pfeifferi*).
*Eurymyctera*, KAUP, *l. c.*, 72, (*crudelis*).
*Polyuranodon*, KAUP, *l. c.*, 96, (*kuhli = polyuranodon*).
*Tæniophis*, KAUP, Aale Hamburg Mus., Nachtrage, 10, 1859, (*westphali = funebris*).
*Priodonophis*, KAUP, Aalenähnliche Fische Hamburg Museum, 22, 1859, (*ocellatus*).
*Neomuræna*, GIRARD, U. S. Mex. Bound. Surv., Fishes, 76, 1859, (*nigromarginata = ocellatus*).
*Pseudomuræna*, JOHNSON, Proc. Zoöl. Soc. London, 1860, 167, (*madeirensis*).
*Gymnothorax*, GÜNTHER, Cat,, VIII, 100, 1870, (*meleagris*, etc.).

This genus, as here understood, comprises the great bulk of the *Murænidæ*, including all the species with sharp teeth, the body normally formed, the anterior nostrils only tubular, and the dorsal fin beginning on the head. *Priodonophis* with serrated teeth has been recognized as a distinct genus by Bleeker, but the character in question disappears by degrees and seems not to be suitable for generic distinction. The Morays of this genus are everywhere abundant in the tropical seas, where some of them reach a great size. They are the most active and voracious of the eels, often showing much pugnacity. Most of them live in shallow water about rocks or reefs. (λύκος, wolf; ὀδούς, tooth.)

LYCODONTIS:

*a.* Teeth all entire, with no serrations anywhere, and none of them with basal lobes.

*b.* Body without black transverse bands, or very large, irregularly placed black spots.

*c.* Body without small, round, bluish white or yellow spots, the spots, if any, blackish or dull grayish; dorsal without distinct paler margin, or with merely the very edge whitish.

*d.* Dorsal with a distinct black margin; anal with a pale edge; teeth uniserial.

*e.* Color nearly plain brown, finely freckled; 13 teeth on side of lower jaw; tail equal to head and trunk. VERRILLI, 644.

*ee.* Color brownish, finely mottled with darker brown; 22 teeth on sides of lower jaw; tail longer than head and trunk. VICINUS, 645.

*dd.* Dorsal without distinct, darker margin, its border colored nearly or quite like rest of fin.

*f.* Body and tail covered with close-set dark points; tail longer than rest of body. VIRESCENS, 646.

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[*] There is in America only one complete set of the Calcutta Journal of Natural History, and that is in the Library of the Academy of Natural Sciences of Philadelphia. In Vol. v of this Journal is found McClelland's paper upon the Apodal Fishes of Bengal, in which several new generic and specific names are proposed. We are indebted to Mr. Witmer Stone, of the Philadelphia Academy, for kindly transcribing portions of that paper for us.

According to Mr. Stone the name *Lycodontis* occurs on page 173, of Vol. v, and three species are assigned to it, viz: *literata* (= *tile*, p. 112, Vol. VIII, of Günther's Catalogue), *punctata* (= *tile*, ibid. Günther), and *longicaudata* (= *sathele*, p. 126, Günther).

The name *Thærodontis* occurs, with diagnosis, on page 174, one page later than *Lycodontis*, and but one species, *reticulata* (= *tessellata*, p. 106, Günther). Of these two names, *Lycodontis* must take precedence of *Thærodontis*.

*ff.* Body and tail not covered with close-set dark points.

*g.* Color olivaceous or brownish, with conspicuous markings, marblings or spots darker than the ground color ; belly without distinct transverse lines, marked like the back and sides ; tail slightly longer than rest of body.

*h.* Dark markings forming narrow reticulations, never rounded spots ; these reticulations dark lilac in color, covering back and sides, some of them enclosing irregular polygons. POLYGONIUS, 647.

*hh.* Dark markings in the form of rounded spots, more or less confluent, sometimes obscuring the pale ground color. MORINGA, 648.

*gg.* Color dark brown, dark green, or blackish, either plain or with faint markings.

*i.* Belly with black, wavy, transverse lines ; no dark lines along dorsal fin. MORDAX, 649.

*ii.* Belly without black transverse lines ; dorsal and anal with dark longitudinal streaks ; body nearly plain dark olive brown. FUNEBRIS, 650.

*ggg.* Color brownish black with irregular pale grayish spots of various sizes ; margin of anal not pale ; cleft of mouth less than half head. SANCTÆ-HELENÆ, 651.

*cc.* Body with distinct small spots, blue, white, or yellow.

*j.* Dorsal and anal without distinct colored margin ; pale spots mostly smaller than eye.

*k.* Teeth of upper jaw uniserial.

*l.* Vomerine teeth uniserial ; spots irregular, few, and scattered ; dorsal colored like back. DOVII, 652.

*ll.* Vomerine teeth biserial ; entire body covered with small blue dots; dorsal with vertical bluish streaks. CONSPERSUS, 653.

*kk.* Teeth of upper jaw biserial ; body with small yellow spots.

*m.* Vomerine teeth uniserial, mostly small and rounded ; color nearly uniform from head to tail ; spots innumerable. MILIARIS, 654.

*mm.* Vomerine teeth biserial, small and rounded ; color dark brown, with yellow points excessively numerous. ELABORATUS, 655.

*jj.* Dorsal with a blackish border, interrupted with white ; anal with white markings ; body with close-set, irregular pale spots. OBSCURATUS, 656.

*bb.* Body with about 20 black, transverse rings, about three times the breadth of the interspaces ; tail a little longer than rest of body. CHLEVASTES, 657.

PRIODONOPHIS, (πρίων, saw ; ὀδούς, tooth ; ὄφις, snake):

*aa.* Teeth serrate, more or less.

*n.* Color brown, with irregular light yellowish spots irregularly placed ; dorsal with large, dark spots on its edge, these sometimes obsolete, usually running together to form a continuous dark band ; anal black-edged ; teeth large, uniserial, the larger ones serrate ; mouth nearly closing. OCELLATUS, 658.

## Subgenus LYCODONTIS.

### 644. LYCODONTIS VERRILLI (Jordan & Gilbert).

Teeth all entire. Color nearly plain brown, finely freckled; teeth uniserial, about 13 on side of lower jaw ; vomerine teeth small, in a short row posteriorly ; eye near angle of mouth, 3 in snout; head 3¼ in trunk; tail about equal to head and trunk ; color light chestnut brown, finely freckled, but without distinct spots ; dorsal with a conspicuous edge of blackish, the margin narrowly white ; anal edged with white. Panama; one specimen known, in the museum of Yale University. (Named for Prof. Addison E. Verrill, of Yale University, a well-known naturalist.)

*Sidera verrilli*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 623, Panama. (Coll. Prof. Bradley.)

*Gymnothorax verrilli*, JORDAN & DAVIS, *l. c.*, 599.

### 645. LYCODONTIS VICINUS (Castelnau).

Teeth all entire, uniserial; lower jaw with about 22 teeth on each side; canines well developed; gill openings narrower than the eye; eye large, 2 in snout, which is long, narrow and pointed; mouth capable of being completely closed; cleft of mouth 2 to 2½ in head; head long, about half length of trunk; tail longer than rest of body by about ⅘ length of head. Brown everywhere, finely mottled with darker brown or purplish; angle of mouth dusky; dorsal with a dusky edge, the fin marked with dark streaks as in *L. funebris*; anal edged with whitish; black spot at gill opening faint or obsolete. Tropical Atlantic, Cuba to Africa and Brazil; rather scarce; our specimen from Bahia. (*vicinus*, near; to *L. moringa.*)

*Murænophis vicina*, CASTELNAU, Anim. Amér. Sud, Poiss., 81, pl. 42, fig. 4, 1855, Bahia.

*Gymnothorax versipunctatus*, POEY, Enumeratio, 156, 1875, Cuba.

*Thyrsoidea maculipinnis*, KAUP, Apodes, 86, 1856, Gold Coast.

*Muræna vicina*, GÜNTHER, Cat., VIII, 121, 1870.

*Muræna maculipinnis*, GÜNTHER, Cat., VIII, 124, 1870.

*Gymnothorax vicinus*, JORDAN, Proc. U. S. Nat. Mus., 1890, 315; JORDAN & DAVIS, *l. c.*, 600.

*Thyrsoidea cormura*, KAUP, Aale Hamb. Mus., 26, 1859.

*Thyrsoidea marginata*, KAUP, *l. c.*, 24.

### 646. LYCODONTIS VIRESCENS (Poey).

Teeth uniserial, entire; gill opening larger than eye; tail longer than rest of body; depth of body 13⅗ in length; head 3 in trunk; cleft of mouth not quite half head. Olivaceous; head and tail with close-set dark points most distinct about gill opening; snout chestnut; dorsal mottled with gray and yellow, without distinct darker margin, its border colored like the fin; anal with a yellow border. Cuba; unknown to us. (Poey.) (*virescens*, greenish.)

*Gymnothorax virescens*, POEY, Enumeratio, 156, 1875, Cuba; JORDAN & DAVIS, *l. c.*, 600.

### 647. LYCODONTIS POLYGONIUS (Poey).

Teeth uniserial, stout, and strong, not close set; eye 2½ in snout; cleft of mouth 2 to 2½ in head; head 2½ in trunk, 3½ in tail, the tail slightly longer than rest of body. Dark markings forming narrow reticulations, never rounded spots; body and tail light olive, everywhere covered with reticulations of dark lilac, the patches of ground color inclosed by the ultimate reticulations, mostly smaller than pupil; some of the reticulations more conspicuous and inclosing irregular polygons or squares considerably larger than eye; the lines are so branched that these markings are not easily traceable; margin of anal broadly yellowish; a trace of a pale line on edge of dorsal. Cuba; two specimens known, both examined by us. (*polygonius*, πολυγώνιος, with polygons.)

*Gymnothorax polygonius*, POEY, Ann. N. Y. Lyc. Nat. Hist., 68, 1870, Havana; JORDAN & DAVIS, *l. c.*, 600.

*Sidera vicina*, JORDAN, Proc. U. S. Nat. Mus., 1886, 34, (not *Murænophis vicinus*, CASTELNAU.)

### 648. LYCODONTIS MORINGA (Cuvier).

(COMMON SPOTTED MORAY; HAMLET.)

Teeth uniserial, irregular in size in the jaws, those in the front of the mouth long, slender canines; vomer with one or two large, depressible teeth in front and usually a row of small teeth behind; eye rather large, about 2 in snout (2¾ to 3 in dark specimens, the pigment encroaching on the cornea, so that the eye seems notably smaller); cleft of mouth 2¼ in head; head 2 to 3 in trunk; tail usually a little longer than the head and trunk. Dark markings in the form of rounded spots, which are more or less confluent, sometimes reducing the pale ground color to narrow reticulations on a surface of black; ground color yellowish, the body covered with brown or black spots of varying size, never much smaller than the pupil of the eye, and sometimes so largely confluent as to make the ground color appear as yellow reticulations on a face of black; relative extent of light and dark markings subject to very great variations; spots on head and snout generally smaller; each pore on lower jaw generally placed in a large pale spot; dorsal and anal fins spotted like the body; margin of anal fin narrowly yellowish, this marking obliterated in dark specimens. West Indies, Pensacola to Rio Janeiro and St. Helena; very common, and very variable in amount of dark coloration, although the pattern of markings is very constant. The most abundant eel in the West Indies. (*Moringa*, a Portuguese corruption of Moray or *Muræna.*)

*Muræna maculata nigra*, (the Black Moray), CATESBY, Nat. Hist. Carolina, pl. 21, 1738, Bahamas.
?? *Gymnothorax afer*, BLOCH, Ich., pl. 417, 1795, Africa.
*Muræna moringa*, CUVIER, Règne, Animal, ed. II, Vol. II, 352, 1829, (after CATESBY); GÜNTHER, Cat., VIII, 120, 1870; GOODE, Bull. U. S. Nat. Mus., v, 72, 1876.
*Gymnothorax rostratus*, AGASSIZ, Spix, Pisc. Bras., 91, pl. 50 a, 1830, Brazil.
*Muræna moringua*, RICHARDSON, Voy. Erebus and Terror, Fishes, 89, 1844, Jamaica.
*Muræna punctata*, GRONOW, Catalogue Fishes, 18, 1854, North America.
*Murenophis curvilineata*, CASTELNAU, Anim. Amér. Sud, Poiss., 81, pl. 42, fig. 2, 1855, Rio Janeiro.
*Murenophis caramura*, CASTELNAU, Anim. Nouv. Rares, Amérique du Sud, 85, pl. 43, fig. 1, 1855, Bahia.
*Gymnothorax flavoscriptus*, POEY, Enumeratio, 158, 1875, Cuba.
*Gymnothorax picturatus*, POEY, Anal. Soc. Esp. Hist. Nat., 257, 1880, Cuba.
*Sidera moringa*, JORDAN, Proc. U. S. Nat. Mus., 1884, 111.
*Gymnothorax moringua*, JORDAN & DAVIS, *l. c.*, 601.

### 649. LYCODONTIS MORDAX (Ayres).

(CONGER EEL OF CALIFORNIA.)

Snout short, narrow, and pointed. Occipital region becoming fleshy and much elevated with age. Tail forming not quite half the total length. Head 7 in length, 2⅓ to 3⅕ in trunk; tube of anterior nostril half as long as the eye; posterior nostril with a slight border. Eye above the middle of the gape, 2¼ to 3¼ in snout, which is 6½ in rest of head. Gape 2½ to 3¼ in head. Gill opening slightly larger than eye. Sides of the upper jaw with two series of teeth posteriorly, the outer series of small, close-set, recurved, triangular teeth, which are immovable; inner teeth about 5, similar, but larger, depressible; a groove between the two series; in front of these, continuous with the outer series, are 3 fixed, knife-shaped teeth, then a movable tooth, then 3 fixed teeth; on the middle line of vomer 3 depressible fangs, the posterior the largest of the teeth; in the lower jaw a single series, corresponding to the outer series in the upper jaw, some of the front teeth enlarged and fixed. Dark brown, vaguely reticulated with narrow, paler markings and spots; a round dark blotch about gill opening; lower side of head and throat with about 15 dark lengthwise streaks; belly with similar streaks running crosswise; dark line on each side of base of anal, with short cross branches. Reaches a length of five feet. Point Concepcion to Cerros Island; abundant about the Santa Barbara islands, remarkable for its ferocity. A food fish of some importance. (*mordax*, prone to bite.)

*Muræna mordax*, Ayres, Proc. Ac. Nat. Sci. Cal., 1859, 30, **Cerros Island**; Jordan & Gilbert, Synopsis, 356, 1883; Jordan, Proc. U. S. Nat. Mus., 1880, 30.
*Sidera mordax*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1883, 210.
*Gymnothorax mordax*, Jordan & Davis, *l. c.*, 610.

### 650. LYCODONTIS FUNEBRIS (Ranzani).

(Black Moray; Morena Verde.)

Tail a little longer than head and trunk. Teeth uniserial in the jaws in the adults; teeth on vomer uniserial (var. *? erebus*), or biserial (*funebris*); long, depressible canines on front of vomer; eye 2 to 2½ in snout, above middle of gape; cleft of mouth 2½ in head; head 2½ in trunk. Color dark olive brown, nearly plain, paler on throat, sometimes with very faint darker marblings; dorsal and anal fins with dark lines running longitudinally; belly without black transverse lines. Jaws not completely closing. Tropical America, on both coasts; the largest of our eels, reaching 5 or 6 feet or more; extremely ferocious; common from Florida Keys to Rio Janeiro, and from Gulf of California to Panama.* A very similar species (*prasinus*) regarded by Dr. Günther as the same, occurs in the East Indies. (*funebris*, funereal, from its dark color.)

*Muræna maculata nigra et viridis*, (*The Moray*), Catesby, Nat. Hist. Carolina, pl. 20, 1738, **Bahamas.**
*Gymnothorax funebris*, Ranzani, Nov. Comm. Ac. Sc. Inst. Bonon., iv, 76, 1840, **Brazil**; Jordan & Davis, *l. c.*, 603.
*Muræna lineopinnis*, Richardson, Voy. Erebus & Terror, Fish., 89, 1844, **Puerto Cabello.**
*Tæniophis westphali*, Kaup, Aale Hamburg Mus. Nachtrag., 1, 1859.
*Thyrsoidea aterrima*, Kaup, Aale Hamburg Mus., 22, 1859.
*Muræna infernalis*, Poey, Memorias, ii, 347, 354, 1860, **Cuba.**
*Thyrsoidea concolor*, Abbott, Proc. Ac. Nat. Sci. Phila., 1860, 479, **Vera Cruz.**
*Muræna erebus*, Poey, Memorias, ii, 426, 1860, **Cuba.**
*Sidera castanea*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 647, **Mazatlan.** (Type, Nos. 28246, 29535, and 29591. Coll. Gilbert.)
*Muræna afra*, Günther, Cat., viii, 123, 1870, (not after Bloch, which is more like *moringa*).
*Muræna aterrima*, Günther, Cat., viii, 124, 1870.
*Sidera funebris*, Bean & Dresel, Proc. U. S. Nat. Mus., 1884, 169.

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* *Lycodontis castaneus* of the Pacific is probably distinct from *Lycodontis funebris*.

### 651. LYCODONTIS SANCTÆ-HELENÆ (Günther).

Cleft of mouth less than half of head; teeth of jaws irregularly biserial; vomerine teeth biserial; snout rather produced and narrow; eye situated above the middle of gape, 2½ in snout; cleft of mouth contained 2¼ in head; head 2½ in trunk; tail longer than rest of body. Brownish black, with numerous rather irregular pale grayish spots, the largest about the size of the eye, the smallest mere dots; each spot again marbled with darker, the smaller and larger spots mixed together. (Gunther.) Tropical Atlantic, recorded from St. Helena and the Bermudas.

*Muræna sanctæ-helenæ*, GÜNTHER, Cat., VIII, 115, 1870, St. Helena. (Coll. J. C. Melliss); BEAN, Proc. U. S. Nat. Mus., 1880, 113.
*Gymnothorax sanctæ-helenæ*, JORDAN & DAVIS, *l. c.*, 602.

### 652. LYCODONTIS DOVII (Günther).

(MORENA PINTITA.)

Teeth all uniserial, those on lower jaw small, compressed, directed backwards; front of lower jaw with several canines; upper with some fixed canines among the other teeth; head 2 to 2½ in trunk; cleft of mouth 2 to 2½ in head; tail longer than body. Brownish or blackish, with small round bluish or yellowish spots, ocellated or not, these spots scattered, irregular in position, and smaller than eye; dorsal colored like the back. Gulf of California to the Galapagos; rather scarce; variable. (Named for Captain John M. Dow.)

*Muræna dovii*, GÜNTHER, Cat., VIII, 103, 1870, Panama. (Coll. Capt. Dow.)
*Muræna pintita*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1881, 346, Mazatlan. (Type, No, 28311. Coll. Gilbert.)
*Sidera dovii*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1883, 209.
*Gymnothorax dovii*, JORDAN & DAVIS, *l. c.*, 604.

### 653. LYCODONTIS CONSPERSUS (Poey).

Vomerine teeth biserial; mandible with about 17 teeth on each side. Head 2½ in trunk; tail but little longer than rest of body. Entire body covered with small blue dots one-sixth diameter of eye, the distance between them being equal to diameter of eye; front and top of head without dots; dorsal with vertical cross streaks of bluish. (Poey.) Cuba to Rio Janeiro. (*conspersus*, speckled.)

*Murænophis punctata*, CASTELNAU, Anim. Nouv. Rares Amér. Sud, 82, 1855, Rio Janeiro; (not *Gymnothorax punctatus*, BLOCH).
*Gymnothorax conspersus*, POEY, Repertorio, II, 259, 1868, Cuba; JORDAN & DAVIS, *l. c.*, 604.
*Muræna conspersa*, GÜNTHER, Cat., 102, 1870.

### 654. LYCODONTIS MILIARIS (Kaup).

Teeth of upper jaw biserial. Vomerine teeth uniserial, mostly small and rounded. Teeth biserial, except on vomer and side of mandible; canines small; mouth can be shut completely; gill opening as wide as eye; eye 2 in snout; cleft of mouth 2½ in head; head 2½ in body; tail rather longer than rest of body. Color nearly uniform from head to tail; brown or black, entirely covered with innumerable yellowish dots, the largest the size of a small pin head. (Günther.) West Indies. (*miliaris*, in thousands, referring to the spots.)

*Thrysoidea miliaris*, KAUP, Apodes, 90, 1856, Martinique.

*Muræna multiocellata*, POEY, Memorias, II, 324, 1860, Cuba; based on specimens with smaller spots than usual.

*Gymnothorax scriptus*, POEY, Repertorio, II, 261, 1868, Cuba.

*Muræna miliaris*, GÜNTHER, Cat., VIII, 100, 1870.

*Gymnothorax miliaris*, JORDAN & DAVIS, *l. c.*, 604.

### 655. LYCODONTIS ELABORATUS (Poey).

Vomerine teeth biserial, small, and bluntly rounded. Mouth not closing completely; teeth of upper jaw biserial, those of the inner series larger; teeth of the lower jaw biserial anteriorly; eye over middle of gape, 2¼ in snout; head 2⅞ in trunk, 4½ in tail, which is a little longer than rest of body; gill opening large. Color dark brown, faintly mottled with darker, the whole body, including fins, covered with points of clear yellow, those on the head close-set and minute, like needle points, but as large as a pin head on the tail; (middle of body with intricate markings of yellow, in the form of linear dashes, according to Poey; none shown on our specimen). Cuba; two specimens recorded. (*elaboratus*, labored over, from the markings.)

*Muræna elaborata*, POEY, Memorias, II, 323, 1860, Cuba; POEY, Repertorio, II, 262, 1868.

*Gymnothorax elaboratus*, JORDAN & DAVIS, *l. c.*, 605.

### 656. LYCODONTIS OBSCURATUS (Poey).

Anterior teeth of upper jaw long and sharp, the rest small and in one series; vomerine teeth in one row, three large canines in front, the rest small; teeth on lower jaw small, with two longer ones on each side in front; head 2½ in trunk; cleft of mouth 2 in head; tail a head's length longer than the rest of the body. Body marbled with brown on a greenish ground, dark enough to almost obscure the marblings, which are composed of close-set spots as large as the pupil, often bordered on one side with a white edging, the spots sometimes being all white; dorsal fins with a blackish border, sometimes interrupted with white; anal all black, with a white border. (Poey.) Cuba; not seen by us. (*obscuratus*, darkened.)

*Gymnothorax obscuratus*, POEY, Ann. N. Y. Lyc. Nat. Hist., IX, 1870, 320, Cuba; JORDAN & DAVIS, *l. c.*, 605.

### 657. LYCODONTIS CHLEVASTES (Jordan & Gilbert).

Head with 3½ rings which do not meet below; tip of snout in one ring, the top and front of snout on median line pale. Upper teeth biserial, the rest uniserial; dentary with about 14 teeth on each side; eye 2 in snout, midway between tip of snout and angle of mouth; head 2⅔ in trunk; head and trunk a little shorter than tail; mouth completely closing. Color pale yellowish brown, with about 20 blackish rings, which are usually three times the breadth of the interspaces; these rings broadest above, extending over the fins; tip of tail black. Galapagos Islands; one specimen known; a remarkably handsome species. (*χλευαστής*, a harlequin.)

*Sidera chlevastes*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1883, 208, Galapagos. (Type, No. 20385. Coll. Capt. Herendeen.)
*Gymnothorax chlevastes*, JORDAN & DAVIS, *l. c.*, 605.

### Subgenus PRIODONOPHIS, Kaup.

### 658. LYCODONTIS OCELLATUS (Agassiz).

(SPOTTED MORAY.)

Teeth all uniserial in jaws, rather large and strong, the posterior edge of the larger teeth serrate, like the teeth of a shark; vomer with few small teeth or none; jaws nearly or quite closing; head 2 to 2½ in trunk, 3½ to 4½ in tail; eye 1¼ to 1¾ in snout; cleft of mouth 2½ to 3 in the head; tail a little longer than rest of body. Color brown above, lighter below, with irregular light yellowish spots, variable in size and sometimes so thickly placed that the ground work appears as brown reticulations; dorsal fin with large dark spots on the edge, the spots often running together, so as to form a black band (or sometimes obsolete); anal fin with a dark edge.

In typical specimens, (var. *ocellatus*), the spots are of moderate size, much larger than pupil, rounded and yellowish in color, subequal and not so wide as the interspaces; cheeks coarsely spotted. West Indian Fauna. Pensacola to Rio Janeiro; a small species, rarely exceeding 18 inches in length; abundant and variable. (*ocellatus*, with eye-like spots.)

*Gymnothorax ocellatus*, AGASSIZ, Spix, Pisc. Brasil, 91, pl. 50 b, 1828, Brazil; GOODE & BEAN, Proc. U. S. Nat Mus., 1879, 344; JORDAN & DAVIS, *l. c.*, 606.
*Priodonophis ocellatus*, POEY, Synopsis, 427, 1868.
*Muræna ocellata*, GÜNTHER, VII, 102, 1870; JORDAN & GILBERT, Synopsis, 356, 1883.

Represented in deeper water off Cuba and the Pensacola Snapper Banks by

### 658a. LYCODONTIS OCELLATUS SAXICOLA (Jordan & Davis).

Edge of dorsal and anal with confluent black blotches, forming a dark margin to the fin, the anal chiefly black. Dark ground color forming reticulations around roundish and polygonal pale spots of various sizes, these larger on the tail, the spots everywhere much wider than the interspaces. Otherwise similar to the typical *ocellatus*. (*saxum*, rock; *colo*, I inhabit.)

*Muræna meleagris*, QUOY & GAIMARD, Voy. Freycinet, Zoöl., 245, pl. 52, fig. 2, 1824, (not of SHAW).
*Gymnothorax ocellatus saxicola*, JORDAN & DAVIS, *l. c.*, 606, Snapper Banks off Pensacola.
*Priodonophis meleagris*, POEY, Repertorio, II, 262, 1867.
*Sidera ocellata*, JORDAN, Proc. Ac. Nat. Sci. Phila., 1882, 42.
*Muræna ocellata*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1884, 260.

Replaced in shallow, sandy bays (Pensacola Bay; St. Joseph Island, Texas) by

### 658b. LYCODONTIS OCELLATUS NIGROMARGINATUS (Girard).

Spots very small, stellate, not much larger than pupil; spots whitish; cheeks finely spotted like the rest of the body; body slender, a dusky shade along sides; fins chiefly black. Otherwise similar to var. *ocellatus*. (*niger*, black; *marginatus*, edged.)

*Neomurænа nigromarginata*, Girard, U. S. and Mex. Bound. Surv., 76, pl. 41, 1859, **St. Joseph Island, Texas.** (Coll. Würdemann).
*Sidera nigromarginata*, Jordan & Evermann, Proc. U. S. Nat. Mus., 1886, 473.
*Gmnothorax occellatus nigromarginatus.* Jordan & Davis, *l. c.*, 606.

## 191. MURÆNA (Artedi) Linnæus.

### (Morays.)

*Muræna*, Artedi, Gen. Pisc., 23, 1738, (in part; includes all eels).
*Muræna*, Klein, Hist. Nat. Pisc., 28, 1742, (in part; includes all eels without pectoral fins).
*Muræna*, Linnæus, x, 243, 1758, (*helena*, etc., includes all eels).
*Muræna*, Thunberg & Ahl, De Muræna et Ophictho, 6, 1789, (restricted to *helena*, etc., includes species without pectoral fins).
*Gymnothorax*, Bloch, Ichthyologia, 1795, Morays, (*reticularis*).
*Muræna*, Günther, and of authors generally, (not of Bleeker).
*Murænophis*, Lacépède, Hist. Nat. Poiss., v, 630, 1803, (*helena*, etc.).
*Limamuræna*, Kaup, Apodes, 95, 1856, (*guttata*).

This genus as now restricted contains some ten species found in the tropical seas, distinguished from *Lycodontis* and from the rest of the family by the presence of two pairs of nasal barbels. The name *Murœna*, originally applied to all eels, should be restricted to the group typified by *Murœna helena.* It was first limited by Thunberg & Ahl, in 1789, to the eels with out pectoral fins, those with such fins being set off as *Ophichthus.* (Μύραινα, (Moray), ancient name of *Murœna helena.*)

*a.* Teeth of upper jaw in one series;* all the teeth uniserial in the adult, those of the upper jaw sometimes biserial in the young.
  *b.* Mouth capable of being completely closed.
    *c.* Body with round pale spots, most numerous on belly and tail, the ground color dark brown; gill opening black. INSULARUM, 659.
    *cc.* Body with many very fine yellow spots, the ground color brown, with three rows of diffuse yellow blotches. ARGUS, 660.
  *bb.* Mouth not closing completely, the jaws curved along the gape; body with well-defined reticulations, inclosing yellowish spots; gill opening black. RETIFERA, 661.
*aa.* Teeth of sides of upper jaw biserial, those of the inner series larger and farther apart; jaws capable of being completely closed.
  *d.* Body scantily spotted, the spots obscure and whitish; gill opening largely black. MELANOTIS, 662.
  *dd.* Body profusely spotted, the spots light yellow, edged with brown; gill opening merely dusky. LENTIGINOSA, 663.

### 659. MURÆNA INSULARUM, Jordan & Davis.

Mouth capable of being completely closed, the jaws being nearly straight along the commissure. Teeth all uniserial, entire, directed backwards, most of them movable; lower teeth 12 on each side, rather remote and comparatively large; no larger canines in front of upper jaw; teeth of upper jaw subequal, about 12 on each side, those in front smallest; vomerine teeth small, uniserial, directed backward; posterior nasal tubes well developed, nearly as large as anterior; dorsal beginning before gill opening; eye over middle of gape, 2½ in snout; snout 2 in gape; head 2½ in trunk; gape 2½ in head; head and trunk a trifle shorter than tail. Color very dark leather-brown or almost black; throat marbled with paler; a

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*Character not verified in *Muræna argus*, which may belong to *aa*.

black spot around gill opening; dorsal mottled with grayish; posterior part of body with a few scattered round grayish spots about as large as pupil; these irregular in size and position and rather faint, most numerous around vent and on anal fin; sides of tail nearly or quite plain; angle of mouth dark. Length 20 inches. Galapagos Islands; one specimen known; resembling the European *Muræna helena*, but less mottled and more distinctly spotted. (*insularum*, of the islands.)

*Muræna insularum*, JORDAN & DAVIS, Apodal Fishes, 609, 1892, Chatham Island. (Type, No. 38300. Coll. Dr. W. H. Jones.)

### 660. MURÆNA ARGUS (Steindachner).

Jaws capable of being completely closed. Teeth all uniserial; those of upper jaw strong, sharp-pointed, recurved; vomerine teeth much smaller, preceded by two long canines; head 6½ in total length; eye 2½ in snout; snout 5½ in head. Body with three rows of diffuse yellow blotches, including fine spots. Color clear brown with a reddish tinge; very small yellow spots covering head, body and fins, mixed here and there with larger spots; large yellowish blotches arranged in three rows along the body; the lower row fainter than upper. (Steindachner.) Altata, west coast of Mexico; not seen by us. (*Argus*, the hundred-eyed, from the innumerable spots.)

*Gymnothorax* (*Limamuræna*) *argus*, STEINDACHNER, Ich. Notizen, x, 17, pl. IV, 1870, Altata.
*Muræna argus*, JORDAN & DAVIS, *l. c.*, 610.

### 661. MURÆNA RETIFERA, Goode & Bean.

Vomerine teeth small, sharp; teeth all uniserial, large and strong in the jaws; those in front not enlarged; head 2¾ to 3 in trunk; tail a little longer than rest of body. Jaws curved along the gape so that they can not be completely closed. Body covered by well-defined reticulations, inclosing light yellowish brown spots, which posteriorly are arranged in groups of 5 to 8; gill opening largely black, within a conspicuous dark blotch; angle of mouth with a dark spot; inside of mouth with yellowish brown spots. Coast of South Carolina, in rather deep water, occasionally brought to the Charleston markets. (*rete*, net; *fero*, I bear.)

*Muræna retifera*, GOODE & BEAN, Proc. U. S. Nat. Mus., 1882, 435, off Charleston. (Type No. 31393. Coll. C. C. Leslie.) JORDAN & GILBERT, Synopsis, 894, 1883; JORDAN, Cat. Fish. N. A., 51, 1885; JORDAN & DAVIS, *l. c.*, 610.

### 662. MURÆNA MELANOTIS (Kaup).

Cleft of mouth 2½ to 2⅓ in head; head 2¼ to 2½ in trunk; tail a little longer than rest of body; teeth of upper jaw anteriorly in two rows, the inner teeth larger and farther apart; canines moderate. Color dark brown with many small obscure whitish spots, these sometimes over whole body, sometimes confined to head and back anteriorly; belly plain brown; dark spot on gill opening and at angle of mouth always conspicuous; a pale spot on base of lower jaw before the dark one. Tropical Atlantic, from Africa to South America, its range in the West Indies uncertain, from confusion with other species. (*μέλας*, black; *οὖς*, ear.)

*Limamuræna melanotis*, Kaup, Aale Hamb. Mus., 27, pl. 4, fig. 3, 1859.

*Muræna melanotis*, Günther, Cat., viii, 98, 1870; Steindachner, Fische Afrikas, 33, 1881; Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 624; Jordan & Gilbert, Synopsis, 355, 1883.

*Muræna melanotis*, Jordan & Davis, *l. c.*, 610.

### 663. MURÆNA LENTIGINOSA, Jenyns.

(Morena Pinta.)

Teeth of upper jaw biserial, the inner series of depressible canines; teeth on lower jaw and vomer uniserial; eye 2 to 2½ in snout, situated over the middle of gape; cleft of mouth 2½ to 3 in head; head 2 to 2⅖ in trunk. Jaws capable of being completely closed. Body profusely spotted; angle of mouth with little or no black; gill opening dusky; general color brown, the body with light yellow, distinctly brown-edged spots, which are about as large as pupil, sometimes larger; towards the end of tail the dark edgings form brown spots; snout, jaws, and belly spotted, as also the dorsal and anal; a faint dusky bar from base of dorsal to behind cleft of mouth; spots more numerous around gill openings. Pacific Coast of America from Gulf of California to Galapagos; generally common, varying considerably in shade of color. (*lentiginosus*, freckled.)

*Muræna lentiginosa*, Jenyns, Voy. Beagle, Zoöl., 143, 1842, Galapagos Islands; Günther, Cat., viii, 99, 1870.

*Muræna pinta*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1881, 345, Mazatlan. (Type, No. 28238. Coll. Gilbert.) Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 371; Jordan & Gilbert, ibid, 381; Jordan & Davis, *l. c.*, 610.

## 192. ECHIDNA, Forster.

*Echidna*, Forster, Enchiridion, 31, 1778, (*variegata*).

*Gymnomuræna*, Lacépède, Hist. Nat. Poiss., v, 648, 1803, (*doliata* = *marmorata*).

*Gymnopsis*, Rafinesque, Analyse Nature, 1815, 93, (*doliata*).

*Megaderus*, Rafinesque, *l. c.*, 93, (*variegata*).

*Molarii*, Richardson, Voyage Erebus & Terror, 79, 1844, (*ophis* = *nebulosa*).

*Pœcilophis*, Kaup, Apodes, 98, 1856, (*catenatus*).

*Gymnomuræna*, Kaup, Apodes, 98, 1856, (*variegata* = *nebulosa*).

This well-marked genus is distinguished from the other Morays by the blunt teeth. The name *Echidna* was suggested for this group of eels long before its application by Cuvier to a genus of Australian Monotremes. There are some 12 or 15 species of *Echidna*, most of them belonging to the Western Pacific. This genus represents the highest degree of specialization among the Morays, as *Uropterygius* represents the extreme of degradation. (ἔχιδνα, ἔχις, viper.)

*a.* Color dark, with small, round yellowish spots; teeth subequal, bluntish, less obtuse than in *E. catenata*, mostly uniserial; dorsal high, beginning over gill opening; head 2¾ in trunk; tail about a snout's length shorter than rest of body. nocturna, 664.

*aa.* Color brownish, marbled and barred with paler; head 3 to 3¼ in trunk, 3½ in tail. catenata, 665.

### 664. ECHIDNA NOCTURNA (Cope).

Teeth subequal, bluntish, less obtuse than in *E. catenata*, mostly uniserial; dorsal high, beginning over gill opening; head short and blunt, the small eye half the snout; head 2¾ in trunk; cleft of mouth 3 in head;

tail about a snout's length shorter than rest of body. Color dark brown, with small, round, yellow spots, smaller than pupil, like pin points, scattered evenly and sparsely over the body; spots with blackish margins; lower jaw mottled. Pacific coast of Mexico, the two known specimens from Rio Grande, Costa Rica, and from Cape San Lucas. Cope says of his specimen that the anal fin is a little more than one-third the total length, which is not true of the one here described. (*nocturnus*, nocturnal, black.)

*Pœcilophis nocturnus*, Cope, U. S. Geol. Surv. Mont., 474, 1871 (1872), Rio Grande, at San José, Costa Rica. (Coll. Dr. Van Patton.)
*Echidna nocturna*, Jordan & Davis, *l. c.*, 612.

### 665. ECHIDNA CATENATA (Bloch).

Head 3 to 3¼ in trunk, 3½ in tail; eye small, 1½ to 2 in snout; cleft of mouth 3 to 3½ in head; tail a trifle longer than rest of body; teeth of upper jaw more or less biserial. Color, brownish black, marbled or reticulated with light yellow or white, the light markings sometimes forming narrow irregular crossbars; under the jaw and on the belly the light yellow often predominates, inclosing dark spots. West Indies, from Bermuda to Surinam; a small species, generally common; our specimens from San Lucia. (*catenatus*, chained, from the chain-like cross bands.)

*Muræna seu conger brasiliensis*, Seba, Thesaurus, II, 72, pl. 69, figs. 4, 5, 1738, Brazil.
*Gymnothorax catenatus*, Bloch, Ausl. Fische, XII, 74, pl. 415, fig. 1, 1795, Coromandel; an error.
*Muræna sordida*, Cuvier, Règne Animal, Ed. 1, 233, 1817, after Seba.
*Murænophis catenula*, Lacépède, v, 628 and 641, 1803, after Bloch, Palmerston Island.
*Murænophis undulata*, Lacépède, v, 629, pl. 292, 1803.
*Muræna alusis*, Bleeker, Act. Soc. Sc. Ind. Neerl., 67, 1855.
*Echidna flavoscripta*, Poey, Repertorio, II, 264, Cuba.
*Echidna fuscomaculata*, Poey, Repertorio, II, 263, 1868, Cuba.
*Muræna catenata*, Günther, Cat., VIII, 130, 1870; Goode, Bull. U. S. Nat. Mus., v., 73, 1876; Jordan, Proc. U. S. Nat. Mus., 1889, 647.
*Echidna catenata*, Jordan & Davis, *l. c.*, 612.

## 193. UROPTERYGIUS, Rüppell.

*Gymnomuræna*, Lacépède, Hist. Nat. Poiss., v, 618, 1803, (*doliata*; *marmorata*). (Restricted first by Kaup, in 1856, to *doliata*, which is a species of *Echidna*.)
*Icthyophis*, Lesson, Voyage de la Coquille, II, 120, 1830, (*pantherinus* = *marmoratus*; not of Fitzinger, 1829, a genus of reptiles).
*Uropterygius*, Rüppell, Neue Wirbelthiere, Fische, 83, 1838, (*concolor*).
*Murænoblenna*, Kaup, Apodal Fishes, 97, 1856, (*tigrina*), (not of Lacépède, 1803, which is *Myxine*).
*Gymnomuræna*, Bleeker, Günther, etc., (not of Lacépède, as restricted by Kaup).
*Scutica*, Jordan & Evermann, new subgenus, (*necturus*).

This genus contains several species of small Morays, distinguished by the apparent absence of fins. The teeth are small, pointed, and subequal, and the cleft of mouth of moderate size. In spite of its simplicity of structure, it is not by any means a primitive type, but a further degeneration from the form of *Lycodontis* and *Muræna*. Our species (with *U. tigrinis*) differs from the type of *Uropterygius* in having only the anterior nostrils tubular. This may define a new subgenus, *Scutica* (*scutica*, a whip). (*οὐρά*, tail; *πτέρυξ*, fin.)

### Subgenus SCUTICA, Jordan & Evermann.

#### 666. UROPTERYGIUS NECTURUS (Jordan & Gilbert).

Teeth in jaws biserial, outer teeth small, close together; inner row composed of long depressible canines, not close-set, vomerine teeth uniserial; a pore situated just above the posterior nostril; tail rather acute with a very slight dorsal fold, more conspicuous in old specimens, its tip in young specimens white; caudal fin obsolete; eye 2 to 2½ in snout; cleft of mouth 2½ to 2⅓ in head; head 3⅓ in trunk; tail ⅓ longer than rest of body. Anterior nostril with a short tube; posterior without tube, situated directly over the eye. Body dark brown above; below paler, with small, dark freckles and pale spots; under side of lower jaw light colored with brown and whitish blotches. Length 12 inches. Gulf of California; not rare. (*νήκτης*, swimmer; *οὐρά*, tail.)

*Gymnomuræna nectura*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 356, **Cape San Lucas.** (Type, No. 15442. Coll. Xantus.)

*Muræenoblenna nectura*, JORDAN, Cat. Fish. N. A., 51, 1885.

*Uropterygius necturus*, JORDAN & DAVIS, *l. c.*, 586.

## 194. CHANNOMURÆNA, Richardson.

*Channo-Muræna*, RICHARDSON, Voyage Erebus and Terror, 96, 1844, (*vittata*).

This genus is near *Uropterygius*, differing chiefly in the size of the gape, the cleft of the mouth being nearly half the length of the head; the snout is very short, the tail also abbreviated, and there are no evident fins. Species few, gaily colored. (*χάννη*, from *χαίνω*, to yawn; *Muræna*.)

#### 667. CHANNOMURÆNA VITTATA (Richardson).

Fins wanting. Lower jaw projecting; teeth slender, subequal, directed backward; teeth in lower jaw in two series, pointed backwards, the inner teeth the largest, and movable; teeth in upper jaw in three series, the two inner series larger and more or less movable; vomerine teeth in a band, thick-set anteriorly, posteriorly biserial. Eye 1½ in snout, situated in the anterior third of gape; snout 4½ in gape; gape 2 in head; head about 4 in trunk, 2⅔ in tail. Color pale yellowish brown, with about 15 irregular broad chocolate-colored cross bands varying in width, sometimes interrupted, sometimes bifurcated, some of them forming complete rings, the pale interspaces usually edged with lighter yellowish. Coast of Cuba; rare. (*vittatus*, striped.)

*Raro*, PARRA, Dif. Piezas, Hist. Nat., 66, pl. 30, fig. 3, 1780, **Havana.**

*Ichthyophis vittatus*, RICHARDSON, Voy. Sulph., Fish., 114, pl. 53, figs. 7-9, 1844, **locality uncertain**; RICHARDSON, Voyage Erebus and Terror, Fishes, 96, 1844.

*Channomuræna cubensis*, POEY, Repertorio, II, 266, pl. 3, fig. 6, 1867, **Cuba.**

*Gymnomuræna vittata*, GÜNTHER, Cat., VIII, 134, 1870.

## Order R. LYOMERI.

### (THE GULPERS.)

Fishes with 5 or 6 branchial arches, far behind the skull and none modified as branchiostegal or pharyngeal; an imperfectly ossified cranium articulating with the first vertebra by a basi-occipital condyle alone; only 2 cephalic arches, both freely movable, (1) an anterior dentigerous one—the maxillary, and (2) the suspensorial, consisting of the hyomandibular and quadrate bones; no palatine bones nor distinct posterior bony elements to the mandible; an imperfect scapular arch remote from the skull; vertebræ separately ossified but imperfect. (Gill and Ryder.)

This order consists of eel-shaped fishes found in the deep seas. It is apparently a degraded type, perhaps an offshoot from some eel-like form. It is characterized by a general looseness of structure and lack of specialization, unique among the true fishes. "The branchial arches are reduced to very simple bars, on the side of the œsophagus, and have no connection with the cranium; the palato-pterygoid arch is entirely wanting; the suspensorium for the lower jaw is composed of only two pieces, the hyomandibular and the quadrate, of an elongate, subcylindrical form and connected with the skull by a movable joint which allows it to be swung in all directions."

These fishes have very singular pedunculated appendages in place of the lateral line. "The entire organization is peculiar, to the extent of anomaly, and our old conceptions of the characteristics of a fish require to be modified in the light of our knowledge of such strange beings." (Gill.) Dr. Gill is disposed to regard the various records as indicating the existence of two distinct families, *Saccopharyngidæ* and *Eurypharyngidæ*, each represented in our waters by one species. (*λύω*, to loosen; *μέρος*, part.)

## Family LIV. SACCOPHARYNGIDÆ.

### (THE GULPERS.)

*Lyomeri* with the branchio-anal portion much longer than the rostro-branchial; the tail excessively elongate and attenuated; the cranium unknown; the eyes antero-lateral; the maxillary bones moderately extended backwards (in comparison with the Eurypharyngidæ), and apparently not closable against each other; enlarged teeth in one or both jaws; the dorsal and anal fins feebly developed, the pectorals small but broad. Body eel-shaped, the bones deficient in inorganic matter; muscles feebly developed, except those connected with swallowing. Jaws very elongate, the gape, pharynx, and stomach capable of great distension. The trunk moderate, with the vent at its end; snout very short, one nostril on each side in front of the very small eye; maxillary and mandible slender, armed with feeble teeth in one or two series; roof of mouth toothless. Gill openings far behind cranium, placed low; gills very short, and small. Tail excessively elongate, band-shaped, tapering to a point. Dorsal and anal low, rudimentary. Pectorals present, small but broad. Deep seas, but few specimens being on record. These have been referred to three species and two genera, but the assigned distinctive characters of genera and species are all doubtful.

## 195. SACCOPHARYNX, Mitchill.

*Saccopharynx*, MITCHILL, Ann. Lyc. Nat. Hist. N. Y., 1824, 82, (no specific name; the type afterwards called *S. flagellum*).

*Ophiognathus*, HARWOOD, Philos. Trans., 1827, 277, (*ampullaceus*).

Supposed characters of the genus indicated above. (*σάκκος*, sack; *φάρυγξ*, pharynx, the inflated throat resembling the sack of a pelican.)

### 668. SACCOPHARYNX AMPULLACEUS (Harwood).

Both jaws armed with slender, curved, widely set teeth, biserial, or their points in one irregular series, directed inwards. Length of jaws from $\frac{1}{3}$ to $\frac{1}{7}$ that of body, from tip of snout to vent. Dorsal fin commencing a long way behind head, a short distance in front of vent; like the anal, it may or may not reach the tail, which ends in an extremely delicate and thin filament. Pectoral fin very short, but broad, and with about 30 very thin rays. Gill opening an elongate slit; black, with a bluish white line along base of dorsal, and sometimes of anal also. Length of largest specimen about 6 feet, 14+58 inches, the tail 4 times length of trunk. Atlantic Ocean, in deep water. Four specimens known, three of these brought to the surface by having swallowed a fish too large for the capacity of the stomach. (Günther.) (*ampulla*, a flask.)

*Saccopharynx*, MITCHILL, Ann. Lyc. Nat. Hist. N. Y., 1824, 82, Open Atlantic.

*Ophiognathus ampullaceus*, HARWOOD, Phil. Trans., 1827, 52, Atlantic.

*Saccopharynx flagellum*, CUVIER, Règne Anim., Ed. 2, II, 355, 1829, Atlantic; after MITCHILL; GÜNTHER, Cat., VIII, 22, 1870; GÜNTHER, Deep-Sea Fishes, Challenger, 256, 1887; JORDAN & GILBERT, Synopsis, 365, 1883; GILL & RYDER, Proc. U. S. Nat. Mus., 1883, 271.

*Saccopharynx chordatus*, STORER, Synopsis, Fishes N. A., 237, 1846, Open Atlantic; after MITCHILL.

## Family LV. EURYPHARYNGIDÆ.

*Lyomeri* with the branchio-anal portion much shorter than the rostro-branchial; the tail very elongate and moderately attenuated backwards; head flat above, and with a transverse rostral margin, at the outer angles of which the eyes are exposed; maxillaries excessively elongated backwards, parallel, and closing against each other as far as the articulation of the 2 suspensorial bones; with minute teeth on each jaw; dorsal and anal fins well developed and continued nearly to the end of the tail; the pectoral fins minute, narrow. (Gill & Ryder.) Deep-sea fishes; 2 genera* and two species known.

### 196. GASTROSTOMUS, Gill & Ryder.

*Gastrostomus*, GILL & RYDER, Proc. U. S. Nat. Mus., VI, 1883, 271, (*bairdii*).

Cranium abbreviated and little or no longer than broad, the dentigerous bones almost seven times as long as the cranium; minute, acute, conic teeth, depressed inwards in a very narrow band on the jaws; no enlarged teeth at extremity of mandible; tail with an eradiate membrane under its terminal portion. (Gill & Ryder.) (*γαστήρ*, stomach; *στόμα*, mouth.)

### 669. GASTROSTOMUS BAIRDII, Gill & Ryder.

Jaws with minute, acute, conical teeth, depressed inwards, in a very narrow band, without fangs at the end of lower jaw. Length of jaws more than half body, measured from snout to vent. Origin of dorsal nearer to tip of snout than to front of anal; neither dorsal nor anal reaching tip of tail; gill openings narrow. Black, with no whitish streak along base of dorsal. Length 18½ inches, the body 6½ inches. Deep water off Newfoundland banks, 389 to 1,467 fathoms; also taken in Davis Strait. (Named for Spencer Fullerton Baird.)

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* The supposed genus and species, *Eurypharynx pelecanoides*, Vaillant, (Comptes Rendus, 1882, 1226) from deep water off Morocco, has the jaws about half length of body to vent, both jaws with feeble dental granulations, and the lower jaw with two fangs in front.

*Gastrostomus bairdii*, Gill & Ryder, Proc. U. S. Nat. Mus., vi, 1883, 271, off the Grand Banks of Newfoundland. (Type, Nos. 33294, 33295, and 33386. Coll. Albatross.)

## Order S. ISOSPONDYLI.

### (The Isospondylous Fishes.)

Soft-rayed fishes with the anterior vertebræ simple, unmodified and without auditory ossicles; symplectic present; no interclavicles; opercular bones distinct; pharyngeal bones simple above and below, the lower not falciform. Mesocoracoid* arch always well developed, as in the *Ostariophysi* and the Ganoids, forming a bridge from the hypercoracoid to the hypocoracoid. Bones of jaws developed, the maxillary broad, always distinct from premaxillary, and forming part of margin of upper jaw; no barbels. Shoulder girdle well developed and connected with the cranium by a bony post-temporal. Gills 4, a slit behind the fourth. Air bladder, if present, with a pneumatic duct. Dorsal and anal fins without true spines. Ventral fins abdominal, sometimes wanting. Scales usually cycloid, sometimes ctenoid; occasionally wanting. No developed photophores. Adipose fin present or absent. A large group comprising most of the marine soft-rayed fishes, excepting those found in the deep sea, these composing the degenerate group called *Iniomi*. Some of the forms, as *Elopidæ*, *Albulidæ*, etc., show analogies with the Ganoid allies of the *Cycloganoidea*. This seems to indicate the probable descent of the *Isospondyli* from a Ganoid stock, but probably not from the same part of the Ganoid series as that from which the *Ostariophysi* have sprung. (*ἴσος*, equal; *σπόνδυλος*, vertebræ.)

Clupeoidea:

*a.* Adipose fin none.

*b.* Dorsal fin inserted more or less before anal (rarely slightly behind it); shore fishes or river fishes, usually silvery in coloration and with the skeleton firm; air bladder well developed.

*c.* Gular plate present, between branches of lower jaw; mouth large; teeth present, all pointed; axillary scales and sheaths large. Elopidæ, lvi.

*cc.* Gular plate none.

*d.* Lateral line well developed.

*e.* Teeth present, no accessory branchial organ.

*f.* Mouth small, horizontal; posterior part of tongue and roof of mouth covered with course paved teeth. Albulidæ, lvii.

*ff.* Mouth large, the teeth all pointed, some of them canine, none paved or molar. Hiodontidæ, lviii.

*ee.* Teeth none; an accessory branchial organ behind gill cavity. Chanidæ, lix.

*dd.* Lateral line wanting; no gular plate.

*g.* Mouth small, inferior, toothless, the maxillary simple or nearly so; stomach gizzard-like. Dorosomidæ, lx.

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* Precoracoid of Cope; "Spangenstück" of Gegenbaur.

*gg.* Mouth moderate, terminal, the maxillary of about three pieces; stomach not gizzard-like. CLUPEIDÆ, LXI.

*ggg.* Mouth subinferior, very large, below a tapering, pig-like snout; maxillary very long. ENGRAULIDIDÆ, LXII.

*bb.* Dorsal fin posterior, opposite anal; deep-sea fishes, of loose organization; mostly blackish in color; mouth small, with small pointed teeth; air bladder wanting. ALEPOCEPHALIDÆ, LXIII.

SALMONIDEA:

*aa.* Adipose fin well developed; oviducts none, the large eggs usually falling into the cavity of the abdomen before extrusion; air bladder well developed.

*h.* Stomach siphonal, not having the form of a blind sac; pyloric cœca many; branchiostegals rather numerous.

*i.* Parietals separated by the supraoccipital; dorsal fin moderate, the simple rays in front few in number. SALMONIDÆ, LXIV.

*ii.* Parietals in contact, not separated by a supraoccipital; dorsal fin very long and high, the simple rays in its anterior half very numerous. THYMALLIDÆ, LXV.

*hh.* Stomach cœcal, of the form of a blind sac; pyloric cœca generally few.

*j.* Branchiostegals 6 or more; gill membranes separate. ARGENTINIDÆ, LXVI.

*jj.* Branchiostegals 3 or 4; body subterete; mouth small. MICROSTOMIDÆ, LXVII.

## Family LVI. ELOPIDÆ.

### (THE TARPONS.)

Body elongate, more or less compressed, covered with silvery, cycloid scales; head naked. Mouth broad, terminal, the lower jaw prominent. Premaxillaries not protractile, short, the maxillaries forming the lateral margins of the upper jaw; maxillary composed of about three pieces, extending backward beyond the eye; an elongate bony plate between the branches of the lower jaw (analogous to the gular plate in *Amia* *); bands of villiform teeth in both jaws and on vomer, palatines, pterygoids, tongue, and base of skull; no large teeth. Eye large, with an adipose eyelid. Opercular bones thin, with expanded membranaceous borders; a scaly occipital collar. Gill membranes entirely separate, free from the isthmus. Branchiostegals numerous, (29 to 35). Gill rakers long and slender. Pseudobranchiæ present or absent. Belly not keeled nor serrated, rather broad and covered with ordinary scales. Lateral line present. Dorsal fin inserted over or slightly behind ventrals; caudal fin forked; no adipose fin; dorsal and anal depressible into a sheath of scales; pectorals and ventrals each with a long accessory scale. Parietal bones meeting along top of head. Pyloric cœca numerous. Genera three, species about five, forming two well-marked subfamilies, both widely distributed in the tropical seas. The species are not much valued as food, the flesh being dry and bony. (*Clupeidæ*, group *Elopina*, Günther, Cat., VII, 469–471, 1868.)

MEGALOPINÆ:

*a.* Pseudobranchiæ none; body oblong, covered with large scales; anal fin larger than dorsal; last ray of dorsal produced in a long filament.

*b.* Dorsal fin inserted notably behind insertion of ventrals. TARPON, 197.

ELOPINÆ:

*aa.* Pseudobranchiæ large; body elongate, covered with small scales; anal fin smaller than dorsal; last ray of dorsal not produced in a filament. ELOPS, 198.

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* The gular plate suggests the similar structure seen in *Amia*, but its homology is not proved. Although the Clupeiform fishes are probably descended from Ganoids related to *Amia*, there may be no closer relation between *Amia* and *Elops* or *Megalops*, than between *Amia* and *Clupea*.

### 197. TARPON, Jordan & Evermann.

(Grande Écaille.)

*Tarpon*, Jordan & Evermann, new genus, (*atlanticus*).

Body oblong, compressed, covered with very large, thick, silvery, cycloid scales; belly narrow, but not carinated, its edge with ordinary scales. Mouth large, oblique, the lower jaw prominent; maxillary broad, extending beyond the eye. Villiform teeth on jaws, vomer, palatines, tongue, sphenoid, and pterygoid bones. Eye very large, with an adipose eyelid. Lateral line nearly straight, its tubes radiating widely over the surface of the scales. Branchiostegals 23. Pseudobranchiæ wanting. Gill rakers long and slender. Dorsal fin short and high, inserted behind the ventrals (over the ventrals in *Megalops*), its last ray elongate and filamentous as in *Megalops*, *Dorosoma*, and *Opisthonema*; anal fin much longer than dorsal, falcate, its last ray produced; caudal widely forked; pectorals and ventrals rather long; anal with a sheath of scales; dorsal naked; caudal more or less scaly; a collar of large scales at the nape. Vertebræ about 57 (28 + 29). Size very large, the largest of the herring-like fishes.

The posterior insertion of the dorsal fin distinguishes the single species of *Tarpon* from the East Indian *Megalops cyprinoides*, a fish of similar habit, in which the dorsal is inserted above the ventrals. (*Tarpon* or *Tarpum*, the common name in Florida, probably of Indian origin.)

#### 670. TARPON ATLANTICUS (Cuvier & Valenciennes).

(Tarpon; Tarpum; Grande Écaille; Silver-fish; Sabalo; Savanilla; Savalle.)

Head 4; depth $3\frac{1}{5}$. D. 12; A. 20; lateral line 42; branchiostegals 23. Body elongate, compressed, little elevated. Dorsal filament longer than head. Mouth large, the maxillary extending beyond eye. Uniform bright silvery, the back darker. Length 6 feet. Long Island to Brazil; common on our southern coasts, but probably not breeding north of Cuba; noted for the great size of its scales, which are used in ornamental work. It reaches a weight of 30 to 110 pounds. It is not much valued for food, although much appreciated by anglers. "An immense and active fish, preying eagerly on schools of small fry, in pursuit of which it ascends fresh-water rivers quite a long distance." (Stearns.) It is often dangerous to seine fishermen, leaping over or through the nets with great force.

*Megalops atlanticus*, Cuvier & Valenciennes, Hist. Nat. Poiss., xix, 398, 1846, Guadeloupe; San Domingo; Martinique; Porto Rico.

*Megalops elongatus*, Girard, Proc. Ac. Nat. Sci. Phila., 1858, 224, Long Island.

*Megalops thrissoides*, Günther, Cat., vii, 472, 1868, and of most authors; but the name *Clupea thrissoides*, Bloch & Schneider, belongs to the East Indian *Megalops cyprinoides*; Jordan & Gilbert, Synopsis, 262, 1883.

### 198. ELOPS, Linnæus.

*Elops*, Linnæus, Syst. Nat., Ed. xii, 518, 1766, (*saurus*).

*Mugilomorus*, Lacépède, Hist. Nat. Poiss., v, 398, 1803, (*anna-carolina*).

*Trichonotus*, Rafinesque, Analyse de la Nature, 1815, 88, (*anna-carolina*); substitute for *Mugilomorus*, considered objectionable.

Body elongate, covered with thin, small, silvery scales. Dorsal fin slightly behind ventrals, its last rays short, the fin depressible into a sheath of scales; anal fin smaller, similarly depressible; pectorals and ventrals moderate, each with a long accessory scale. Opercular bones thin, with expanded, membranaceous borders; a scaly occipital collar. Lateral line straight, its tubes simple. Pseudobranchiæ present, large. Vertebræ 43 + 29 = 72. Large fishes of the open seas, remarkable for the development of scaly sheaths. The young are ribbon-shaped and elongate, passing through a series of changes like those seen in *Albula.* (ἔλοψ, name of some sea fish; a swordfish or sturgeon; from ἐλαύνω, to drive or move.)

### 671. ELOPS SAURUS, Linnæus.

(TEN-POUNDER; JOHN-MARIGGLE; BONY-FISH; BIG-EYED HERRING; MATAJUELO REAL; CHIRO; LISA FRANCESA.)

Head 4¼; depth 5 to 6; eye large, 4 to 5. D. 20; A. 13; V. 15; B. 30; scales 12–120–13. Gular plate 3 to 4 times as long as broad. Length 3 feet. Tropical seas; abundant and very widely distributed. Common in America, north to Carolina and the Gulf of California; straying on the Atlantic Coast to Long Island. (*saurus*, σαῦρος, lizard.)

*Elops saurus*, LINNÆUS, Syst. Nat., Ed. XII, 518, 1766, Carolina; GÜNTHER, Cat., VII, 470, 1868; JORDAN & GILBERT, Synopsis, 261, 1883, and of most authors.

*Argentina carolina*, LINNÆUS, Syst. Nat., Ed. XII, 519, 1766, Carolina.

*Argentina machnata*, FORSKÅL, Descr. Anim., 68, 1775, Djidda, Arabia.

*Mugilomorus anna-carolina*, LACÉPÈDE, Hist. Nat. Poiss., V, 398, 1803, South Carolina.

*Elops inermis*, MITCHILL, Trans. Lit. and Phil. Soc. N. Y., I, 1815, 445, New York.

*Elops capensis*, SMITH, Zoöl. S. Africa, 1845, pl. 7, Cape of Good Hope.

*Elops purpurascens*, RICHARDSON, Ichth. China, 311, 1846, China.

## Family LVII. ALBULIDÆ.

### (THE LADY-FISHES.)

Body rather elongate, little compressed, covered with rather small, brilliantly silvery scales; head naked. Snout conic, subquadrangular, shaped like the snout of a pig, and overlapping the small, inferior, horizontal mouth. Maxillary rather strong, short, with a distinct supplemental bone, slipping under the membranous edge of the very broad preorbital; premaxillaries short, not protractile. Lateral margin of upper jaw formed by the maxillaries; both jaws, vomer, and palatines with bands of villiform teeth; broad patches of coarse, blunt, paved teeth on the tongue behind and on the sphenoid and pterygoid bones. Eye large, median in head, with a bony ridge above it, and almost covered with an annular adipose eyelid. Opercle moderate, firm; preopercle with a broad, flat, membranaceous edge, which extends backward over the base of the opercle. Pseudobranchiæ present. Gill rakers short, tubercle-like. Gill membranes entirely separate, free from the isthmus; branchiostegals about 14; a fold of skin across gill membranes anteriorly, its posterior free edge crenate; no gular plate. Lateral line present. Belly not carinate, flattish, covered with ordinary scales. Dorsal fin moderate, in front of ventrals, its membranes scaly; no adipose fin; anal very small; caudal widely forked. Pyloric cœca numerous. Parietal bones meeting along top of head. Vertebræ numerous, 42 + 28 = 70. A single species known, found in all warm seas. In this, and probably in related families, the young pass through a metamorphosis, analogous to that seen in the Conger Eels. They are for a time elongate, band-shaped, with very small head and loose transparent tissues. From this condition they become gradually shorter and more compact, shrinking from 3 or 3½ inches in length to 2 inches. According to Dr. Gilbert, this process, like that seen in various eels, is a normal one, through which all individuals pass. In the Gulf of California, where these fishes abound, these band-shaped young are often thrown by the waves on the beach in great masses. (*Clupeidæ*, group *Albulina*, Günther, Cat., VII, 468, 469, 1868.)

### 199. ALBULA (Gronow) Bloch & Schneider.

(Lady-fishes.)

*Conorhyncus*, Nozeman, Act. Select, III, 382, 1757, (nonbinomial).
*Albula*, Gronow, Zoöphyl., 102, 1763, (nonbinomial).
*Albula*, Bloch & Schneider, Syst. Ichth., 432, 1801, (*conorhyncus* = *vulpes*).
*Butyrinus*, Lacépède, Hist. Nat. Poiss., v, 45, 1803, (*banana* = *vulpes*).
*Glossodus*, Cuvier, in Agassiz, Spix, Pisc. Bras., 48, 1829, (*forskåli* = *vulpes*).

Characters of the genus included above. (Latin *albus*, white.)

#### 672. ALBULA VULPES (Linnæus).

(Lady-fish; Bone-fish; Macabí; Sanducha; Banana-fish.)

Head 3¾; depth 4. D. 15; A. 8; scales 9–71–7. Upper lobe of caudal the longer. A broad band of peculiar, elongate, membranaceous scales along middle line of back; accessory ventral scale large. Brilliantly silvery; olivaceous above; back and sides with faint streaks along the rows of scales; fins plain; axils dusky. Length 18 inches to 3 feet. Tropical seas, on sandy coasts, almost universally distributed and generally abundant, ranging northward on our coasts to San Diego and Long Island. A beautiful and active fish, in most places little valued as food, but in some regions, as Key West, highly appreciated. (*vulpes*, fox.)

*Unbarana*, Marcgrave, Hist. Bras., 1648, Brazil.
*Vulpes bahamensis*, [the Bone-fish], Catesby, Nat. Hist. Carolinas, etc., pl. II, fig. 1, 1737, Bahamas.
*Esox vulpes*, Linnæus, Syst. Nat., Ed. x, 1758, 313, Bahamas; based on the Bone-fish, *Vulpes bahamensis*, of Catesby.
*Argentina glossodonta*, Forskål, Descr. Anim., 68, 1775, Djidda, Arabia.
*Macabí*, Parra, Dif. Piezas Cuba, 88, pl. 35, fig. 1, 1787, Cuba; based on *Unbarana* of Marcgrave.
*Synodus argenteus*, Bloch & Schneider, Syst. Ichth., 398, 1801, Asia.
*Clupea brasiliensis*, Bloch & Schneider, Syst. Ichth., 427, 1801, Brazil.
*Albula conorynchus*, Bloch & Schneider, Syst. Ichth., 432, 1801, Antilles; after Gronow and Plumier; called *Albula plumieri* on plate 86.
*Amia immaculata*, Bloch & Schneider, Syst. Ichth., 451, 1801, Central America; after *Macabí* of Parra.
*Butyrinus banana*, Lacépède, Hist. Nat. Poiss., v, 46, 1803, Île de France.
*Clupea macrocephala*, Lacépède, Hist. Nat. Poiss., v, 426, 1803, Martinique; on a drawing by Plumier.
*Glossodus forskåli*, Agassiz, Spix, Pisc. Bras., 49, 1829, Bahia; called *Engraulis sericus* and *Engraulis bahiensis* on the plates, 22 and 24.
*Albula parræ*, Cuvier & Valenciennes, Hist. Nat. Poiss., XIX, 339, 1846, Martinique; Bahia; Rio de Janeiro.

*Albula goreensis*, CUVIER & VALENCIENNES, Hist. Nat. Poiss, XIX, 342, 1846, Gorea.
*Albula neoguinaica*, CUVIER & VALENCIENNES, *l. c.*, XIX, 350, 1846, New Guinea.
*Albula seminuda*, CUVIER & VALENCIENNES, *l. c.*, XIX, 351, 1846, New Guinea.
*Albula erythrocheilos*, CUVIER & VALENCIENNES, *l. c.*, XIX, 352, pl. 540, 1846, Friendly Islands
*Albula forsteri*, CUVIER & VALENCIENNES, *l. c.*, XIX, 354, 1846, Tahiti.
*Albula rostrata*, GRONOW, Cat. Fishes, 189, 1854, American Ocean, etc.
*Albula conorhynchus*, GÜNTHER, Cat., VII, 468, 1868.
*Albula vulpes*, JORDAN & GILBERT, Synopsis, 258, 1883.

## Family LVIII. HIODONTIDÆ.

### (THE MOON-EYES.)

Body oblong, much compressed, covered with moderate-sized, brilliantly silvery, cycloid scales. Head naked, short, the snout blunt. Mouth moderate, oblique, terminal, the jaws about equal. Premaxillaries not protractile. Maxillary small, slender, without evident supplemental bone, articulated to the end of the premaxillary, and forming the lateral margin of the upper jaw. Dentition very complete; premaxillary and dentary bones with small, wide-set, cardiform teeth; maxillaries with feeble teeth; a row of strong teeth around the margin of the tongue, the anterior canine and very strong; between these is a band of short, close-set teeth; vomer with a long, double series of close-set, small teeth; similar series on the palatines, sphenoid and pterygoids; sides of lower jaw fitting within the upper, so that the dentaries shut against the palatines. Eye very large, the adipose eyelid not much developed. Preorbital very narrow. Nostrils large, those of each side close together, separated by a flap. Gill membranes not connected, free from the isthmus, a fold of skin covering their base. No gular plate. Branchiostegals 8 to 10. Gill rakers few, short, and thick. Pseudobranchiæ obsolete. Lateral line distinct, straight. Belly not serrated. Dorsal fin rather posterior; anal elongate, low; ventrals well developed; caudal strongly forked; no adipose fin. Stomach horseshoe-shaped, without blind sac; one pyloric cœcum. Vertebræ about 60. Air bladder large. No oviducts, the eggs falling into the cavity of the abdomen before exclusion. A single genus, with three species, inhabiting the fresh waters of North America; handsome and gamy fishes, of little value as food. (*Hyodontidæ*, Günther, Cat., VII, 375, 376, 1868.)

## 200. HIODON, Le Sueur.

### (MOON-EYES.)

*Hiodon*,* LE SUEUR, Journ. Ac. Nat. Sci. Phila., I, 1818, 334, (*tergisus*).
*Glossodon*,* RAFINESQUE, Amer. Monthly Mag., II, September, 1818, 354, (*harengoides*).
*Amphiodon*, RAFINESQUE, Journ. de Physique, 421, 1819, (*alosoides*).
*Clodalus*, RAFINESQUE, Ichth. Oh., 43, 1820, (*clodalus = tergisus*).
*Glossodon*, HECKEL, Russeggers Reisen, I, 1033, 1842, (*smithii = alosoides*).
*Elattonistius*, GILL & JORDAN, Bull. U. S. Nat. Mus., x, 68, 1877, (*chrysopsis = alosoides*).
*Hyodon*, corrected orthography.

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*It is not certain which of these two names, *Hiodon* and *Glossodon*, has precedence of date. *Hiodon* is in common use and was accompanied by a much better description than Rafinesque usually furnished. We therefore retain it.

Generic characters included above. (*ὑοειδής*, hyoid; *ὀδούς*, tooth; "hyoid" is the bone shaped like the letter Υ, forming the base of the tongue.)

AMPHIODON (ἀμφί, both ; ὀδούς, tooth) :

*a.* Belly in front of ventrals carinated ; dorsal with 9 developed rays. ALOSOIDES, 673.

HIODON :

*aa.* Belly in front of ventrals not carinated ; dorsal with 11 or 12 developed rays.

  *b.* Belly behind ventrals carinated ; eye 3 in head. TERGISUS. 674.

  *bb.* Belly nowhere carinated ; eye 2½ in head. SELENOPS, 675.

### Subgenus AMPHIODON, Rafinesque.

### 673. HIODON ALOSOIDES (Rafinesque).

(LA QUESCHE ; NACCAYSH.)

Head 4½; depth 3½; eye 3½. D. 9; A. 32; scales 6–56–7. Body closely compressed, becoming deep in the adult, the ventral edge everywhere carinated. Maxillary reaching to beyond middle of eye. Caudal peduncle rather stouter than in *H. tergisus*, and the fin not so deeply forked. Back less arched and snout blunter than in the other species, the mouth larger and more oblique. Pectorals longer and ventrals shorter than in *H. tergisus*. Bluish; sides silvery, with golden luster. Ohio River and north to the Saskatchewan; common northwestward. (*Alosa*, shad; *εἶδος*, like.)

*Amphiodon alosoides*, (misprinted *alveoides*), RAFINESQUE, Journ. Phys., Paris, 421, 1819, Ohio R.
*Hyodon amphiodon*, RAFINESQUE, Ichth. Oh., 42, 1820, Ohio River near the Falls.
*Hyodon chrysopsis*, RICHARDSON, Fauna Bor.-Amer., III, 232, 1836, Cumberland House, Saskatchewan River ; JORDAN, Bull. U. S. Nat. Mus., X, 68, 1877.
*Hyodon alosoides*, JORDAN & GILBERT, Synopsis, 259, 1883.

### Subgenus HIODON.

### 674. HIODON TERGISUS, Le Sueur.

(MOON EYE ; TOOTHED HERRING.)

Head 4⅓; depth 3; eye 3. D. 12; A. 28; scales 5–55–7. Vertebræ 30 + 31 = 61. Body oblong, moderately compressed. Eye large, the maxillary barely reaching its middle. Pectoral fins not reaching ventrals, the latter just short of vent. Belly behind ventrals somewhat carinate, but not before ventrals. Color brilliantly silvery, olive-shaded above. Length 12 inches. Great Lakes and the Mississippi Valley; north to Assiniboine River; abundant in the larger streams. One of our handsomest fishes, not valued as food, the flesh being dry and full of small bones. (*tergisus*, scoured or polished.)

*Hiodon tergisus*,* LE SUEUR, Journ. Ac. Nat. Sci. Phila., I, 1818, 364, Ohio River.
*Glossodon harengoides*,* RAFINESQUE, Amer. Month. Mag., II, September, 1818, 354, Ohio River.
*Glossodon heterurus*, RAFINESQUE, *l. c.*, 1818, 354, Falls of Ohio River.
*Hiodon clodalus*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., I, 1818, 367, Ohio River at Pittsburg.
*Hyodon vernalis*, RAFINESQUE, Ich. Oh., 42, 1820, Ohio River.
*Cyprinus* (*Abramis ?*) *smithii*, RICHARDSON, Fauna, Bor.-Amer., III, 110, 1836, Richelieu River.
*Hyodon claudalus*, CUVIER & VALENCIENNES, His. Nat. Poiss., XIX, 313, 1846; after LE SUEUR.
*Hyodon tergisus*, GÜNTHER, Cat., VII, 375, 1868; JORDAN, Bul. U. S. Nat. Mus., X, 68, 1877; JORDAN & GILBERT, Synopsis, 259, 1883.

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*We do not know which of the nearly synchronous specific names *tergisus* and *harengoides* is entitled to precedence. *Tergisus* is in common use, was accompanied by a better description and is a better name.

### 675. HIODON SELENOPS, Jordan & Bean.

Head 4⅓; depth 4; eye 2½. D. 12; A. 27; lateral line 50. Body more elongate than in the other species of *Hiodon*, little compressed, not much elevated, the belly nowhere carinate. Eye very large. Pectorals not reaching to ventrals. Coloration clear silvery. Tennessee, Cumberland, and Alabama rivers, scarce; recorded from Nashville, Chattanooga, and Montgomery. (*σελήνη*, moon: *ὤψ*, eye.)

*Hyodon selenops*, JORDAN & BEAN, Bull. U. S. Nat. Mus., x, 67, 1877, Chattanooga, Tenn. (Type, No. 19844); JORDAN & GILBERT, Synopsis, 260, 1883.

## Family LIX. CHANIDÆ.

### (THE MILK FISHES.)

Body oblong, compressed, covered with small, firm, adherent scales. Lateral line distinct. Abdomen broad and flattish. Snout depressed; mouth small, anterior, the lower jaw with a small symphyseal tubercle; no teeth; premaxillary joined to upper anterior edge of maxillary. Eye with an adipose eyelid. Gill membranes broadly united, free from the isthmus. Branchiostegals 4; pseudobranchiæ well developed; an accessory branchial organ in a cavity behind the gill cavity. Dorsal fin opposite the ventrals; anal fin shorter than dorsal. Mucous membrane of œsophagus raised into a spiral fold; intestine with many convolutions. Coloration silvery. Vertebræ about 45. Large fishes of the warmer parts of the Pacific. One genus and three species known. (*Clupeidæ*; group *Chanina*, Günther, Cat., VII, 473, 1868.)

### 201. CHANOS, Lacépède.

*Chanos*, LACÉPÈDE, Hist. Nat. Poiss., v, 395, 1803, (*arabicus*).
*Lutodeira* (KUHL) RÜPPEL, Neue Wirbelthiere Abyssinia, 18, 1835, (*chanos*).
*Ptycholepis*, GRAY, Dieffenbach's Travels in New Zealand, II, 218, about 1842, (*salmoneus*).

Characters of the genus included above. (*χάνος*, name in modern Greek, from *χάνος*, the open mouth.)

### 676. CHANOS CHANOS (Forskål).

(MILK-FISH; SABALO; AWA; CHANI; ANGEO.)

Head 4⅖; depth 4. D. II, 12; A. II, 9; scales 12–86–14. Vertebræ 19 + 26 = 45; snout 3½; eye 3½; maxillary 4⅓. Pectoral 1⅗; ventral 1⅘; caudal ⅓ longer than head; dorsal 1¼ in head. B. 4. Aspect of a large Cyprinoid. Body elliptical, moderately compressed, the caudal peduncle slender. Head pointed, rounded above. Eye and side of head covered by a large transparent, imperforate adipose eyelid. Mouth small, terminal toothless, transverse, the lower jaw included; maxillary broad, slipping under the adipose preorbital, without supplemental bone. Opercle truncate behind. Pseudbranchiæ very large. Gill rakers fine and flexible, very close set, rather long. Bones of gill rakers flexible. Gill arches all connected by membrane. Lateral line well developed. Scales firm, cycloid, with strongly marked longitudinal striæ. Scales rather large, hard, firm, enamelled, becoming bony when dry, used by the Indians for ornamental work. Dorsal inserted somewhat nearer snout than base of caudal, before ventrals, its first ray falcate, its last produced in a short filament, longer than pupil; base of fin with a large scaly sheath; pectoral and ventral with scaly axillary appendage; anal similar to dorsal but much smaller; pectorals and ventrals rather small; caudal very long, forked to the base, its lobes subequal, straight; base of fin with small scale; ventrals somewhat falcate. Color greenish above, the sides brilliantly silvery, fins more or less darkened; inside of ventrals and pectorals blackish. Length 2 to 5 feet. Pacific and Indian oceans, on sandy shores, north to the Hawaiian Islands and to the Gulf of California, where it is abundant; a food fish of some importance; occasionally entering streams.

*Mugil chanos*, Forskål, Descr. Anim., 74, 1775, Red Sea at Djidda, Arabia.

*Mugil salmoneus* (Forster) Bloch & Schneider, Syst. Ichth., 121, 1801, Pacific Ocean.

*Chanos arabicus*, Lacépède, Hist. Nat. Poiss., v, 396, 1803, Arabia.

*Cyprinus pala* and *tolo*, Cuvier, Règne Anim., Ed. 2, ii, 276, 1829, India.

*Leuciscus zeylonicus*, Bennett, Proc. Comm. Zool. Soc., 184, 1832, Ceylon.

*Butirinus maderaspatensis*, Jerdon, Madr. Journ. Lit. Sc., xv, 344, Madras.

*Chanos mento*, Isle of France, *chloropterus*, Madipolam, *nuchalis*, Vigazapatam, *orientalis*, Japan, and *cyprinella*, Hawaiian Islands, Cuvier & Valenciennes, Hist. Nat. Poiss., xix, 194, 198, 1846.

*Chanos indicus*, Bleeker, Verh. Bat. Gen., xxiv, 11, 1852, East Indies.

*Chanos salmoneus*, Günther, Cat., vii, 473, 1868.

## Family LX. DOROSOMIDÆ.

### (The Gizzard Shads.)

Body short and deep, strongly compressed, covered with thin, deciduous, cycloid scales. Belly compressed to an edge, which is armed with bony serratures. Head naked, short, rather small. Mouth small, inferior, oblique, overlapped by the blunt snout; no teeth; maxillary narrow and short, with a single supplemental bone, not extending to opposite middle of eye, and forming but a small portion of lateral margin of upper jaw; mandible short and deep, its rami enlarged at base; premaxillaries not protractile. Gill rakers slender, exceedingly numerous, not very long, similar on all the arches. Gill membranes not united, free from the isthmus; branchiostegals about 6; pseudobranchiæ large. An adipose eyelid. No lateral line. Dorsal fin about midway of the body, usually behind ventrals. Pectorals and ventrals moderate, each with an accessory scale. Anal very long and low; caudal forked. No adipose fin. Vertebræ 49. Stomach short, muscular, like the gizzard of a fowl. A single genus in our waters; species about 10. Mud-eating fishes of the coasts and rivers of warm regions, of little value as food. The family is very close to the *Clupeidæ*, the distinguishing characters being not of great importance. (*Clupeidæ*, group *Chatoëssina* Günther, Cat., vii, 406–411, 1868.)

### 202. **DOROSOMA**, Rafinesque.

### (Gizzard Shad.)

*Dorosoma*, Rafinesque, Ichth. Oh., 39, 1820, (*notata* = *cepedianum*).

*Chatoëssus*, Cuvier, Règne Animal, Ed. 2, Vol. ii, 320, 1829; in part, (includes *Opisthonema*, etc.).

*Chatoëssus*, Cuvier & Valenciennes, Hist. Nat. Poiss., xxi, 94, 1848, (*cepedianus*).

Characters of the family, with the addition that the last ray of the dorsal is prolonged and filiform as in *Opisthonema*, *Megalops*, and *Tarpon*.

a character which separates *Dorosoma* from the Asiatic genus *Anodontostoma*. (*δόρυ*, lance; *σῶμα*, body; in allusion to form of body in the young.)

*a*. Anal rays 30 to 33; lower jaw included. CEPEDIANUM, 677.
*aa*. Anal rays 20 to 25; jaws subequal.
  *b*. Dorsal fin inserted just behind ventrals; 9 scutes behind ventrals. MEXICANUM, 678.
  *bb*. Dorsal fin inserted just before ventrals; 12 scutes behind ventrals. PETENENSE, 679.

### 677. DOROSOMA CEPEDIANUM (Le Sueur).

(GIZZARD SHAD; HICKORY SHAD.)

Head 4⅓; depth 2½; eye 4½. D. 12; A. 31; scales 56–23; scutes 17 + 12. Body deep, compressed, the back elevated in the adults. Dorsal about median, slightly behind ventrals, its filamentous ray about as long as head, sometimes longer, sometimes shorter. Caudal widely forked, the lower lobe the longer. Silvery; bluish above; young with a round dark spot at the shoulder; tips of ventrals and edge of anal often dusky. Length 15 inches. Cape Cod to Mexico; abundant southward, entering all rivers, and permanently resident (var. *heterurum*) everywhere in the Mississippi Valley in the larger streams; also introduced into Lake Michigan and Lake Erie, and landlocked in ponds from New Jersey to Texas. A handsome fish, of no value as food. (Named for Bernard Germain Étienne de la Ville sur Illon, Comte de La Cépède (1756–1825), known as Citoyen Lacépedè during the French Revolution; a brilliant and most industrious writer, who compiled his great Histoire Naturelle des Poissons under most difficult conditions during the French revolution.)

*Megalops cepediana*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., I, 1818, 361, Delaware and Chesapeake bays.
*Clupea heterura*, RAFINESQUE, Amer. Monthly Mag., 1818, 354, Ohio River.
*Dorosoma notata*, RAFINESQUE, Ichth. Oh., 39, 1820, Ohio River.
*Chatoëssus ellipticus*, KIRTLAND, Report Zoöl. Ohio, 169, 1839, Ohio River.
*Dorosoma insociabilis*, ABBOTT, Proc. Ac. Nat. Sci. Phila., 1860, 365, Sturgeon Pond, Trenton, New Jersey.
*Chatoëssus cepedianus*, GÜNTHER, Cat., VII, 409, 1868.
*Dorosoma cepedianum*, JORDAN & GILBERT, Synopsis, 271, 1883.

Represented along coast and in lower courses of rivers of Texas by

### 677a. DOROSOMA CEPEDIANUM EXILE, Jordan & Gilbert.

Body elongate, the depth about one-third the length. (*exilis*, slender.)

*Dorosoma cepedianum exile*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 585, Galveston. (Type, No. 30913. Coll. Jordan.)

### 678. DOROSOMA MEXICANUM (Günther)

Head 3⅕; depth 2¾; eye 4. D. 14; A. 25; scales 40–13. Maxillary extending to below front of eye, which is equal to snout; jaws equal. Dorsal inserted just behind ventrals, its filament reaching end of anal; nine scutes behind ventrals. Silvery, with a small black humeral spot. East coast of Mexico. (Günther.)

*Chatoëssus mexicanus*, GÜNTHER, Cat., VII, 409, 1868, Mexico. (Coll. M. Sallé.)
*Dorosoma mexicanum*, JORDAN & GILBERT, Synopsis, 887, 1883.

### 679. DOROSOMA PETENENSE (Günther).

Head 3½; depth 2¾; eye 3½. D. 14 or 15; A. 20 to 23; lateral line 40. Maxillary extending to below front of eye, which is longer than snout; jaws equal. Dorsal inserted slightly in advance of ventrals and nearer tip of snout than base of caudal, its filament reaching end of anal; 12 scutes behind ventrals. Silvery, with a small, round black humeral spot. Lake Peten, Yucatan. (Günther.)

*Chatoëssus petenensis*, Günther, Cat., vii, 408, 1868, Lake Peten, Yucatan. (Coll. Salvin.)

## Family LXI. CLUPEIDÆ.

### (The Herrings.)

Body oblong or elongate, more or less compressed, covered with cycloid or pectinated scales. Belly sometimes rounded, sometimes compressed, in which case it is often armed with bony serratures. Head naked, usually compressed. Mouth rather large, terminal, the jaws about equal; maxillaries forming the lateral margins of the upper jaw, each composed of about three pieces. Premaxillaries not protractile; teeth mostly small, often feeble or wanting, variously arranged. Adipose eyelid present or absent. Gill rakers long and slender; gill membranes not connected, free from the isthmus. No gular plate. Gills 4, a slit behind the fourth. Branchiostegals usually few (6 to 15). Posterior lower part of opercular region often with an angular emargination, the tips of the larger branchiostegals being abruptly truncate. Pseudobranchiæ present. No lateral line. Dorsal fin median or somewhat posterior, rarely wanting. No adipose fin. Ventrals moderate or small (wanting in *Pristigaster*). Anal usually rather long; caudal fin forked. Vertebræ 40 to 56. Genera about 30; species 150; inhabiting all seas, and usually swimming in immense schools; many species ascend fresh waters, and some remain there permanently. The northern and fresh-water species, as in many other families, differ from the tropical forms in having a larger number of vertebral segments. (*Clupeidæ*, groups *Clupeina* and *Dussumieriina*, Günther, Cat., vii, 413–467, 1868.)

DUSSUMIERIINÆ:

- *a.* Belly rounded, covered with ordinary scales; supplemental bones of maxillary very narrow; anal fin short.
  - *b.* Ventral small; teeth small, persistent, on jaws, vomer, palatines, pterygoids, and tongue.
    - *c.* Scales of breast not forming a corselet.
      - *d.* Species very small, with the teeth minute; a silvery lateral band; the dorsal short, of 11 to 16 rays; ventrals inserted nearly under its front. JENKINSIA, 203.
      - *dd.* Species of moderate size, with moderate teeth; no silvery lateral band; the dorsal long, of 18 to 20 developed rays; the ventrals inserted much behind dorsal, much nearer base of caudal than tip of snout. ETRUMEUS, 204.
    - *cc.* Scales of breast adherent, forming a ventral corselet, which covers the closed pectoral fins, except the upper edge and tip. PERKINSIA, 205.
- *aa.* Belly compressed, armed with bony serræ; supplemental bones of maxillary broad.

Clupeinæ:

- *e.* Anal fin moderate, of 15 to 25 rays; dorsal inserted nearly opposite ventrals.
  - *f.* Scales with their posterior margins entire and rounded; intestinal canal of moderate length.
    - *g.* Last ray of dorsal not produced.
      - *h.* Vertebræ about 50 in number (46 to 56); species of northern regions.
        - *i.* Vomer with teeth; ventral scutes weak, ventrals below middle of dorsal; vertebræ 50 to 56. Clupea, 206.
        - *ii.* Vomer without teeth.
          - *j.* Ventral scutes very weak, the belly more or less rounded; vertebræ about 52; ventrals under middle of dorsal. Clupanodon, 207.
          - *jj.* Ventral scutes strong, the belly compressed; vertebræ 46 to 50; ventrals below or slightly behind front of dorsal.
            - *k.* Premaxillaries meeting at a large angle, so that the tip of upper jaw does not appear to be notched; cheeks longer than deep. Pomolobus, 208.
            - *kk.* Premaxillaries meeting in front at a very acute angle, so that the emarginate front of the upper jaw receives the slender tip of the lower; fore part of cheeks very deep, deeper than long; jaws toothless. Alosa, 209.
      - *hh.* Vertebræ about 42 (40 to 44); tropical species with the scales large and usually firmly attached; ventrals inserted under middle of dorsal; adipose eyelid obsolete. Sardinella, 210.
    - *gg.* Last ray of dorsal produced in a long filament; scales large, not firmly attached; otherwise essentially as in *Clupanodon.* Opisthonema, 211.
  - *ff.* Scales with their posterior margins vertical, and pectinate or fluted; head very large; no teeth; intestines elongate; herbivorous. Brevoortia, 212.

Pristigasterinæ:

- *ee.* Anal fin very long, of more than 30 rays; dorsal fin inserted behind ventrals.
  - *l.* Teeth not all villiform; both jaws with strong canines; ventrals present, very small. Chirocentrodon, 213.
  - *ll.* Teeth all villiform; no canines.
    - *m.* Ventral fins present. Ilisha, 214.
    - *mm.* Ventral fins wanting.
      - *n.* Dorsal fin present, inserted behind front of anal; belly not very convex in outline.
        - *o.* Maxillary not greatly produced backward, not extending behind eye. Opisthopterus, 215.
        - *oo.* Maxillary much produced backward, extending behind eye. Odontognathus, 216.
      - *nn.* Dorsal fin inserted in front of anal; maxillary short; abdomen excessively convex in profile, so that the body is very deep. Pristigaster, 217.

## 203. JENKINSIA, Jordan & Evermann.

*Jenkinsia*, Jordan & Evermann, new genus, (*stolifera*).

Very small species, closely allied to *Etrumeus*, but with minute teeth and a silvery lateral band; the dorsal with less than eighteen rays, the ventrals inserted below or just behind it. American. (Named for Dr. Oliver Peebles Jenkins, Professor of Physiology in Leland Stanford Junior University, in recognition of his work on the fishes of Mexico and the Hawaiian Islands.)

- *a.* Dorsal inserted a little nearer caudal than tip of snout, the ventrals just behind it; dorsal rays about 16; anal 11. acuminata, 680.
- *aa.* Dorsal inserted midway between snout and base of caudal; dorsal rays 14; anal 15. lamprotænia, 681.
- *aaa.* Dorsal inserted nearer snout than base of caudal; dorsal rays 11; anal 17. stolifera, 682.

### 680. JENKINSIA ACUMINATA (Gilbert).

Head 3½; depth 6; eye 4⅕. D. 16 or 17; A. 10 or 11; scales about 60. Body slender, the belly rounded. Eye small, 1⅖ in snout in specimens of 1½ inches in length; snout acuminate, as long as maxillary, 3 in head. Teeth evident in both jaws and on maxillary, vomer, and palatines. Front of dorsal nearer base of caudal than tip of snout; ventrals inserted behind dorsal, slightly nearer base of caudal than base of pectorals. Translucent, with a faint trace of a narrow lateral silvery band, above which is a line of dark specks; black specks on bases of vertical fins. Length 1½ inches. Gulf of California, at 22 fathoms. (Gilbert.)

*Etrumeus acuminatus*, Gilbert, Proc. U. S. Nat. Mus., 1890, 56, Gulf of California. (Coll. Gilbert.)

### 681. JENKINSIA LAMPROTÆNIA (Gosse).

Head 3¾; depth 6. D. 14; A. 15. Snout conical, as long as eye; jaws even. Maxillary narrow, reaching front of eye; minute teeth on jaws, vomer, and palatines. Front of dorsal midway between tip of snout and base of caudal; ventrals below its posterior half. A well-defined silvery lateral band. Jamaica. (Günther.) (λαμπρός, shining; ταινία, band.)

*Clupea lamprotænia*, Gosse, Naturalist's Sojourn Jamaica, 291, pl. 1, fig. 2, 1851, Jamaica.
(*Spratelloides*) *lamprotænia*, Günther, Cat., vii, 465, 1868.

### 682. JENKINSIA STOLIFERA (Jordan & Gilbert).

Head 3¾; depth 5½; eye 2½. D. 11; A. 17; scales caducous, about 36. Body elongate, slender, moderately compressed. Snout sharp, tapering, the jaws equal, the maxillary 2½ in head, reaching slightly beyond front of eye. Teeth minute, evident in both jaws. Eye large. Dorsal high, inserted at a point slightly nearer snout than base of caudal; ventrals under fourth dorsal ray, nearly half head, and slightly shorter than pectorals. Translucent green; sides with a silvery band as in *Stolephorus*, one-fourth depth of body, a little broader than pupil; a double row of dots along back before dorsal and a single row behind; fins pale. Length 2 inches. Gulf of Mexico from Key West to Yucatan. A small silvery fish, very abundant in schools in the surf with *Stolephorus brownii*, a species it much resembles in form and coloration. (*στολή*, *stole*, a stole or white band worn by priests; *fero*, I bear.)

*Dussumieria stolifera*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1884, 25, Key West. (Type, No. 34964. Coll. Jordan.)

## 204. ETRUMEUS, Bleeker.

*Etrumeus*, Bleeker, Verh. Bat. Gen., xxv, Japan, 58, 1853, (*micropus*, a Japanese species).

Body rather elongate, somewhat compressed, the abdomen rounded and without serratures. Mouth terminal, of moderate width, formed as in *Clupea*, but the maxillary more slender. Teeth moderate, in patches on jaws, palatines, pterygoids, and tongue. Scales cycloid, entire, very deciduous. Branchiostegals numerous, very slender. Ventrals inserted posteriorly, entirely behind dorsal; the dorsal fin rather long, of 18 to 20 rays; anal low, of moderate length. Pseudobranchiæ well developed; pyloric cœca numerous. No silvery lateral stripe. Few species. Asiatic and American. (*Ikan Etrumei*, a Japanese name of *Etrumeus micropus.*)

### 683. ETRUMEUS SADINA (Mitchill).

(ROUND HERRING.)

Head 4; depth 6. D. 18; A. 13. Body terete and fusiform. Mouth small, maxillary reaching front of orbit. Vomerine teeth present. Eye large, equal to snout. Fins all very small, the ventrals entirely behind dorsal; the dorsal inserted considerably nearer tip of snout than base of caudal. Axillary scales very long. Olivaceoùs above, silvery on sides and below, no distinct lateral band. Length 10 inches. Cape Cod to the Gulf of Mexico, on sandy shores; not rare southward. (*Sadina*, a diminutive from Shad; Mitchill called the fish the "New York Shadine.")

*Clupea sadina*, MITCHILL, Trans. Lit. and Phil. Soc., I, 1815, 457, New York.
*Alosa teres*, DE KAY, New York Fauna: Fishes, 262, 1842, New York.
*Etrumeus teres*, GÜNTHER, Cat., VII, 467, 1868; JORDAN & GILBERT, Synopsis, 263, 1883.

## 205. PERKINSIA, Rosa Smith Eigenmann.

*Perkinsia*, ROSA SMITH EIGENMANN, Amer. Nat., February, 1891, 153, (*othonops*).

Like *Etrumeus*, except that the pectoral and ventral fins are shielded, the scales of the breast adherent, forming a ventral buckler, which covers the closed pectoral fins, leaving only the dorsal edge and the extreme tip of the fins visible; the closed ventrals likewise slip under a posterior buckler; axillary scales very large, that of pectoral extending nearly to its tip, that of ventral reaching slightly farther than the fin. Caudal deeply forked, the lateral scales extending continuously on the center of the fin almost to margin of middle rays. Adipose eyelid covering the eye wholly without pupillary slit. One species, from California. (Named for Hon. George C. Perkins, then governor of California, a patron of scientific investigation.)

### 684. PERKINSIA OTHONOPS, R. S. Eigenmann.

Head 4; depth 5; eye 3. D. 17; A. 10; scales 50. Head compressed forward; eye longer than snout; interorbital space 4½ in head. Occiput with ridges forming a W, the top of head with a lanceolate, depressed area anteriorly, a median ridge and a triangular area between it and anterior part of the W. Maxillary 3 in head, not reaching pupil, the supplemental bone very narrow. Cheeks, opercles, and humeral scale with branching mucous canals; isthmus triangular, the gill covers not emarginate below. Scales large, deciduous. Teeth as in *Etrumeus sadina*. Pseudobranchiæ exposed Gill rakers long and slender. Insertion of dorsal midway between tip of snout and end of anal; anal small. Ventrals short, 3½ in head, entirely behind dorsal; pectorals 1⅗. Steel-blue, sides silvery; upper fins dusky; ventrals with median dusky blotch; inner surface of pectorals blackish. Length 12 inches. Point Loma, San

Diego; one specimen known. (Eigenmann.) Evidently very close to *Etrumeus* and *Dussumieria*. (ὀθόνη, veil; ὤψ, eye.)

*Perkinsia othonops*, ROSA SMITH EIGENMANN, Amer. Nat., 1891, 153, San Diego, California.

## 206. CLUPEA (Artedi) Linnæus.

### (HERRINGS.)

*Clupea* (ARTEDI) LINNÆUS, Syst. Nat., Ed. x, 1758, 317, (*harengus*).
*Rogenia*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XX, 340, 1847, (*alba*, "the Whitebait," the young of *harengus*).

True Herrings with the body elongate, numerous vertebræ, the ventral serratures weak, and an ovate patch of small but persistent teeth on the vomer. The few species belong to the northern seas, where the number of individuals is inordinately great, exceeding perhaps those of any other genus of fishes. Not anadromous, spawning in the sea. (*Clupea*, herring.)

| | |
|---|---|
| *a.* Belly serrate both before and behind ventrals; anal rays 17. | HARENGUS, 685. |
| *aa.* Belly serrate behind ventrals only; anal rays about 14. | PALLASII, 686. |

### 685. CLUPEA HARENGUS, Linnæus.

### (COMMON HERRING.)

Head 4½; depth 4½; eye 4. D. 18; A. 17; lateral line 57; ventral scutes 28 + 13; vertebræ 56. Body elongate, compressed. Scales loose. Cheeks longer than high, the junction of the mandible and preopercle under middle of eye. Maxillary extending to middle of eye; upper jaw not emarginate; lower jaw much projecting. Vomer with an ovate patch of small permanent teeth; palatine teeth minute, if present; tongue with small teeth; jaws with or without minute teeth. Gill rakers very long, fine, and slender, about 40 on the lower part of the arch. Eye longer than snout. Dorsal inserted rather behind middle of body, in front of ventrals. Pectorals and ventrals short; anal low. Abdomen serrated in front of ventrals as well as behind, the serratures weak. Bluish; silvery below, with bright reflections. Peritoneum dusky. Length 16 inches. North Atlantic Ocean; abundant on the coasts both of Europe and America, chiefly north of Cape Hatteras where it is known as Labrador herring; the young are canned as sardines at Eastport, Me., and elsewhere.* Spawns in the sea. (Eu.) (*harengus*, low Latin for Herring, the word allied to the German *Heer*, army, a fish that swims in armies.)

*Clupea harengus*, LINNÆUS, Syst. Nat., Ed. x, 1758, 317, Seas of Europe; GÜNTHER, Cat., VII, 415, 1868; JORDAN & GILBERT, Synopsis, 265, 1883.
*Clupea esca*, WALBAUM, Artedi, Pisc., III, 36, 1792, English Whitebait.
*Clupea membras*, PALLAS, Zoogr. Ross.-Asiat., III, 211, 1811, Baltic Sea.
*Clupea halec*, MITCHILL, Trans. Lit. and Phil. Soc., I, 1815, 451, New York.
*Clupea vittata*, MITCHILL, *l. c.*, 456, New York.
*Clupea cærulea*, MITCHILL, *l. c.*, 457, 1815, New York.
*Clupea elongata*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., I, 1817, 234, Massachusetts.

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*The herring is abundant only to the north of Cape Cod. Mr. W. C. Kendall reports that it is occasionally taken about Fortress Monroe. It is rare on the coast of Maryland, being, according to Uhler and Lugger, more common after a severe winter.

*Clupea latulus*, Cuvier, Règne Anim., Ed. 2, Vol. II, 318, 1829, Whitebait.
*Clupea leachi*, Yarrell, Zool. Journ., v, 1829, 277, pl. 12, England.
*Clupea minima*, (Peck) Storer, Rept. Fish. Mass., 113, 1839, New Hampshire.
*Clupea lineolata*, Cuvier & Valenciennes, Hist. Nat. Poiss., xx, 256, 1847, locality unknown.
*Rogenia alba*, Cuvier & Valenciennes, the young form known as Whitebait, England.

### 686. CLUPEA PALLASII, Cuvier & Valenciennes.

(California Herring.)

Head 4½; depth 4. D. 16; A. 14; lateral line 52. Lower jaw strongly projecting; upper jaw not emarginate. Belly scarcely compressed in front of ventrals, serrate only between ventrals and anal. Gill rakers very long and slender. Vomerine teeth weaker than in *C. harengus*; usually a few teeth on tongue and premaxillary. Vertebræ also fewer, 30 + 20 = 50. Insertion of dorsal slightly nearer front of eye than base of caudal. Bluish above; sides and below silvery; peritoneum dusky. Length 18 inches. Pacific Coast from Kamchatka to San Diego; very similar to *C. harengus*, and equally abundant. Not entering rivers southward. (Named for Petrus Simon Pallas, of St. Petersburg, naturalist and explorer, author of the excellent Zographia Rosso-Asiatica, 1811.)

*Clupea harengus*, Var., Pallas, Zoogr. Rosso.-Asiat., III, 209, 1811, Kamchatka.
*Clupea pallasii*, Cuvier & Valenciennes, Hist. Nat. Poiss., xx, 253, 1847, Kamchatka; based on Pallas's specimens.
*Clupea mirabilis*, Girard, Proc. Ac. Nat. Sci. Phila., 1854, 138, San Francisco; Günther, Cat., VII, 418, 1868; Jordan & Gilbert, Synopsis, 265, 1883.
*Spratelloides bryoporus*, Cope, Proc. Amer. Philos. Soc., 1873, 25, Sitka; Jordan & Gilbert, Synopsis, 264, 1883.

## 207. CLUPANODON, Lacépède.

(True Sardines.)

*Clupanodon*, Lacépède, Hist. Nat. Poiss., v, 468, 1803, (*pilchardus*, etc.).*
*Thrissa*, Rafinesque, Analyse de la Nature, 1815, 88; substitute for *Clupanodon*, regarded as an objectionable name.
*Sardinia*, Poey, Memorias, II, 311, 1860, (*pseudohispanica*).

This genus is close to *Clupea*, which it resembles in the elongate form and weak ventral serratures. Vomer toothless, the teeth in the jaws mostly weak. Scales thin, deciduous. Adipose eyelid present. Gill rakers very numerous. Species about 6, chiefly confined to the two temperate zones, all closely related to the European Sardine, *Clupanodon pilchardus*, and agreeing with it in the rich and delicate flesh; less firm than that of related species, and much richer in oil. Species marine, not anadromous. Very close to *Pomolobus*, as also to *Clupea*, and perhaps the three should be reunited. (*Clupea*, herring; *ἀνοδοὐς*, without teeth; this genus being supposed to differ from *Clupea* by the absence of teeth.)

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* "Six species are referred by Lacépède to this genus [*Clupanodon*], viz: *thrissa*, L., (*Opisthonema*, Gill), *nasica*, Lac., (*nasus*, Bloch), (*Dorosoma*, Raf.), *pilchardus*, L., (*Sardinia*, Poey), *sinensis*, L., (*Clupeonia*, C. & V.), *africanus*, Bloch, (*Pellona*, C. & V.), *jussieu*, Lac., (*Clupeonia*, C. &. V.). One of these, *Pellona africana*, does not conform to the definition and should be excluded. All the others (except *Dorosoma nasus*) are very closely related and are probably all representatives of sections of the genus *Clupea*, rather than of distinct genera. The name *Clupanodon* is prior to all of these and must take the place of one of them. So far as we know it has never been formally restricted. It seems to us better to consider *C. jussieui* as the type of *Clupanodon* and to substitute *Clupanodon* for *Clupeonia*."—(*Jordan & Gilbert, l. c.*).

Inasmuch as the genus *Sardinia* is of later date than any of the others included under *Clupanodon*, the name *Clupanodon* must be used for its type instead of letting it take the place of *Clupeonia* as above suggested. This arrangement accords with the views of Dr. Gill.

*a.* Opercles conspicuously striate; side with a series of round black spots on level of eye, these obsolete with age; no teeth in jaws. California. CÆRULEUS, 687.

*aa.* Opercles scarcely striate; sides without black spots; minute teeth on tongue and lower jaw. West Indian. PSEUDOHISPANICUS, 688.

### 687. CLUPANODON CÆRULEUS (Girard).

(CALIFORNIA SARDINE.)

Head 4; depth 5. D. 14; A. 17; lateral line 53; scutes 18 + 14. Vertebræ about 50. Body slender, subfusiform, slenderer and less compressed than a herring, the back rather broad. Ventral serratures very weak. Maxillary reaching nearly to middle of eye. Adipose eyelids present, each covering nearly ⅓ of eye. Mandible little projecting, the tip included. No teeth in mouth. Gill rakers longer than eye, very slender and numerous, close-set, some 50 or 60 on lower limb of arch. Opercle truncate behind, the edge vertical, the upper half with conspicuous branching tubes and striæ, the lower with about 7 long striæ extending downward and backward; top of head with bony striæ. A frill of enlarged scales with dendritic striæ about nape and shoulder. Insertion of dorsal considerably nearer snout than base of caudal. Dorsal small, its free edge concave; pectorals and ventrals with sheathing scales; anal small and low, its last two rays enlarged, forming a sort of finlet. Dark-bluish above; silvery below; a series of round black spots on the level of the eye, running backward, bounding the dark color of the back; similar smaller spots above, forming lines along the rows of scales; these spots sometimes obscure or wanting, especially in old examples; tip of lower jaw yellow; lower part of dorsal yellowish; peritoneum black. Flesh darker than that of the herring and more oily. Length 12 inches. Pacific Coast from Puget Sound to Magdalena Bay; abundant on California coast; spawning in the sea. An excellent food-fish. It resembles the European Sardine (*Clupanodon pilchardus*), but has no teeth, and the belly is less strongly serrate. We have not been able to compare the California Sardine with *Clupanodon sagax*[*] from Chili. (*cæruleus*, blue.)

*Maletta cærulea*,[†] GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 138, San Francisco.

*Alausa californica*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 281, California.

*Clupea sagax*, GÜNTHER, Cat., VII, 443, 1868; not of JENYNS;[‡] JORDAN & GILBERT, Synopsis, 965, 1883.

### 688. CLUPANODON PSEUDOHISPANICUS (Poey).

(SARDINA DE ESPAÑA, BANG.)

Head 4; depth 3⅔ to 4½; eye 3⅔. D. 16; A. 16; scales about 45. Vertebræ 46 to 48. Body slender, little compressed, the belly scarcely carinated, its scutes not prominent; mouth small, the maxillary not quite reaching pupil, 2⅗ in head; gill rakers very long, slender, and numerous, 30 to 40 below angle, the longest ⅔ eye. Lower jaw with a few feeble teeth; some minute teeth on tongue. Cheeks much longer than deep, their depth below eye ⅔ eye. Adipose eyelid well developed. Opercle with very faint striæ, preopercle with very few. Caudal well forked, the lower lobe as long as head and a little longer than the upper; ventrals inserted nearly below middle of dorsal, a little nearer base of caudal than tip of snout; pectoral 1⅓ in head, a conspicuous sheath of scales at base. Color bluish, with no distinct markings, sides golden and silvery; peritoneum dusky; opercle dusky within. Intestine 1½ length of body. Length 8 inches. Gulf of Mexico; abundant about Cuba, and not rare in rather deep water off Pensacola and Tampa; also occasionally northward as far as Cape Cod; sometimes taken in abundance at Woods Holl, Mass. (William C. Kendall.) Closely allied to the European Sardine or pilchard (*Clupanodon pilchardus*, L.), but distinguished by the absence of radiating striæ on the opercles, these conspicuous in the true Sardine. (*ψευδής*, false; *ἱσπανικός*, Spanish; the false Spanish Sardine.)

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[*] Very few species of shore fishes are, however, common to the faunæ of California and Chili, and as this sardine is not found on the intervening coast of Mexico, it is best to regard *cærulea* as distinct from *sagax* until positively shown to be identical.

[†] The name *cærulea* is preoccupied in *Clupea*, but not in *Clupanodon*.

[‡] *Clupea sagax*, JENYNS, Zoöl. Beagle, Fishes, 134, 1842, Lima, San Lorenzo Island; *Alosa musica*, GIRARD, U. S. Nav. Astr. Exped., 246, 1855, Chili; *Alosa fimbriata*, KNER & STEINDACHNER, S. A. K. Wiss. Wien, 1866, f. 15, Chili.

*Sardinia pseudohispanica*, POEY, Memorias, II, 311, 1860, Cuba; GÜNTHER, Cat., VII, 442, 1868; JORDAN & GILBERT, Synopsis, 887, 1883.

*Clupea pseudohispanica*, KENDALL & SMITH, Bull. U. S. Fish Comm., XIV, 1894, 17.

## 208. POMOLOBUS, Rafinesque.

### (ALEWIVES.)

*Pomolobus*, RAFINESQUE, Ichth. Oh., 38, 1820, (*chrysochloris*).

*Spratella*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XX, 356, 1847, (*pumila* = young of *Clupea sprattus*).

*Meletta*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XX, 366, 1847 (*vulgaris* = *sprattus*).

*Alausella*, GILL, Proc. Ac. Nat. Sci. Phila., 1861, 35, (*parvula* = *pseudoharengus*).

Body oblong, more or less compressed. Mouth moderate, terminal, the jaws about equal, or the lower projecting, the upper scarcely notched at tip. Teeth feeble, variously placed, probably never wholly absent; mandibles very deep at base, shutting within the maxillaries. Gill rakers more or less long and slender, numerous. Adipose eyelid present. Scales thin, cycloid, deciduous, entire, rounded posteriorly. Cheeks with the free portion longer than deep. Dorsal fin rather short, nearly median, beginning in advance of ventrals, its posterior ray not prolonged in a filament; ventral present; anal moderate. Belly compressed, strongly serrated before and behind ventrals. Flesh rather dry and poor, less oily than in *Clupanodon*. Vertebræ 46 to 55 in number, usually 50. Species numerous, mostly anadromous, the typical species confined to the northern seas, and mostly anadromous. All the northern species agree in having a larger number of vertebræ than is found in the tropical species which constitute the genus *Sardinella*. If this rule holds with the species in other regions, probably those tropical forms usually referred to *Clupea*, constituting the subgenus *Kowala*, etc., should be regarded as distinct alike from *Clupea* and *Pomolobus*. *Pomolobus* is very close to *Clupea*, with which it may perhaps need to be reunited. It seems to us best to regard the true herring, shad, alewife, and sardine as distinct generic groups, although the characters of the dentition on which Valenciennes chiefly relied for distinction have scarcely any value. (*πῶμα*, opercle; *λόβος*, lobe.)

*a.* Teeth in jaws present, those on tip of both jaws mostly persistent; adipose eyelid moderate; peritoneum pale. CHRYSOCHLORIS, 689
*aa.* Teeth in jaws disappearing with age.
  *b.* Peritoneum pale.
    *c.* Head long, about 4 in length; form rather elliptical. MEDIOCRIS, 690.
    *cc.* Head shorter and heavier, about 4⅔ in length; body heavier forward. PSEUDOHARENGUS, 691.
  *bb.* Peritoneum black; fins low. ÆSTIVALIS, 692.

### 689. POMOLOBUS CHRYSOCHLORIS, Rafinesque.

(SKIPJACK; BLUE HERRING.)

Head 3¾; depth 3¾; eye shorter than snout, 4⅓ in head. D. 16; A. 18; lateral line 52; ventral scutes 20 + 13. Body elliptical, highest near the middle, much compressed. Head rather slender and pointed, its upper profile straight. Lower jaw strongly projecting, its tip entering the profile; upper jaw emarginate; premaxillary, and often tip of lower jaw, with moderate-sized persistent teeth; maxillary large, reaching to opposite posterior part of eye. Eye large, well covered by adipose eyelid. Fins moderate. Caudal peduncle slender, the caudal widely forked. Gill rakers comparatively few, short, stout, and coarse, about 23 below the angle of the arch. Opercles with radiating and branching striæ. Brilliant blue above; sides silvery, with golden reflections; no dark spots behind opercle. Peritoneum pale. Length 15 inches. Gulf of Mexico and Mississippi Valley; abundant; resident in all the larger streams, and introduced through the canals into Lake Erie and Lake Michigan. A handsome fish, but worthless for food, as it is lean and bony. As ordinarily seen, it is strictly a fresh-water species, but in the Gulf of Mexico, in rather deep water, specimens of large size and excessively fat, are taken. (*χρυσός*, gold; *χλωρός*, green.)

*Pomolobus chrysochloris*, RAFINESQUE, Ichth. Oh., 38, 1820, Ohio River.
*Meletta suœrii*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., xx, 375, 1847, Wabash River.
*Clupea chrysochloris*, JORDAN & GILBERT, Synopsis, 266, 1883.

### 690. POMOLOBUS MEDIOCRIS (Mitchill).

(HICKORY SHAD; TAILOR HERRING; FALL HERRING; MATTOWACCA.)

Head 4; depth 3⅜. D. 15; A. 21; lateral line 50; ventral scutes 20 + 16. Head comparatively long, the profile straight and not very steep, form more elliptical than in the others, and less heavy forward. Lower jaw considerably projecting; upper jaw emarginate. Opercles rather less emarginate below and behind than in *P. pseudoharengus*. Fins low; dorsal fin inserted nearer snout than base of caudal. Bluish silvery; sides with rather faint longitudinal stripes. Peritoneum pale. Length 24 inches. Cape Cod to Florida; rather common; not highly valued as a food-fish; not ascending streams to spawn. (*mediocris*, mediocre.)

*Clupea mediocri*, MITCHILL, Trans. Lit. and Phil. Soc. N. Y., I, 1815, 450, New York; JORDAN & GILBERT, Synopsis, 266, 1883.

*Clupea mattowacca*, MITCHILL, *l. c.*, I, 1815, 451, pl. 5, fig. 8, New York; GÜNTHER, Cat., VII, 438, 1868.

? *Clupea parvula*, MITCHILL, *l. c.*, I, 1815, 452, New York.

? *Clupea pusilla*, MITCHILL, *l. c.*, I, 1815, 452, New York.

*Clupea fasciata*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., I, 1818, 233, Massachusetts.

*Alosa lineata*, STORER, Proc. Bost. Soc. Nat. Hist., II, 1847, 242, Massachusetts; STORER, Hist. Fishes Mass., 162, 1867.

*Clupea virescens*, DE KAY, New York Fauna: Fishes, 242, 1842, New York.

### 691. POMOLOBUS PSEUDOHARENGUS (Wilson).

(ALEWIFE; BRANCH HERRING; GASPEREAU; WALL-EYED HERRING; BIG-EYED HERRING; ELLWIFE.)

Head 4⅗; depth 3⅓; eye 3½. D. 16; A. 19; lateral line 50; scutes 21 + 14. Body rather deep and compressed, heavy forward. Head short, nearly as deep as long, the profile somewhat steep and slightly depressed above the nostrils. Maxillary extending to posterior margin of pupil. Lower jaw somewhat projecting; upper jaw emarginate. Eye large, slightly longer than snout. Gill-rakers long, 30 to 40 below the angle of the arch, shorter and stouter than in *A. sapidissima*. Lower lobe of caudal the longer. Dorsal fin high, a little higher than long, its height 6½ in length of body. Bluish above; sides silvery; indistinct dark stripes along the rows of scales; a blackish spot behind opercle. Peritoneum pale. Atlantic Coast of the United States; abundant; entering streams to spawn; also landlocked in the lakes of western New York (var. *lacustris*), and in Lake Ontario where it is excessively abundant and where great multitudes sometimes die in early summer. (*ψευδής*, false; *harengus*, herring.)

*Clupea pseudoharengus*, WILSON, Rees's Encycl., IX, about 1811, probably Philadelphia.

*Clupea vernalis*,* MITCHILL, Rept. Fishes N. Y., 22, 1814, and in Trans. Lit. & Phil. Soc. N. Y., I, 1815, 454, New York.

*Clupea megalops*, RAFINESQUE, Amer. Monthly Mag., 1818, 206, Delaware River.

*Meletta venosa*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XX, 374, 1847, New York.

*Pomolobus pseudoharengus lacustris*, JORDAN, Man. Vert., Ed. I, 265, 1876, Cayuga Lake, New York; specimens landlocked.

*Pomolobus pseudoharengus*, GILL, Rept. U. S. Fish Comm., I, 1871–72, 811.

*Pomolobus vernalis*, GOODE & BEAN, Bull. Essex Inst., 24, 1879.

*Clupea vernalis*, JORDAN & GILBERT, Synopsis, 267, 1883.

### 692. POMOLOBUS ÆSTIVALIS (Mitchill).

(GLUT HERRING; BLUE-BACK; BLACK-BELLY; SUMMER HERRING; KYACH; SAW-BELLY.)

Head 5; depth 3½. Similar to the preceding, from which it is best distinguished by the black peritoneum. Body more elongate, the fins lower and the eyes smaller, the back darker. First ray of dorsal not equal to base of fin. Atlantic Coast, appearing later than the preceding; less abundant northward, and less valuable as a food-fish, perhaps ranging farther southward. In the Southern States, more abundant than the preceding, from which few fishermen* distinguish it with certainty. (*æstivalis*, of the summer.)

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* According to Dr. Gill, the paper of Alexander Wilson in Rees's Cyclopedia, was published before 1814, the date of Mitchill's name *vernalis*. See McDonald in Goode, Nat. Hist. Aquat. Anim., 580, 594, 1884.

*Clupea æstivalis*, MITCHILL, Trans. Lit. & Phil. Soc. N. Y., I, 1815, 456, New York.
*Alosa cyanonoton*, STORER, Hist. Fish. Mass., 161, 1867, Provincetown, Massachusetts.
*Pomolobus æstivalis*, GOODE & BEAN, Bull. Essex Inst., 24, 1879.
*Clupea æstivalis*, JORDAN & GILBERT, Synopsis, 267, 1883; MCDONALD, in Hist. Aquat. Anim., 579, 1884.

## 209. ALOSA, Cuvier.

### (THE SHAD.)

*Alosa*, CUVIER, Règne Animal, Ed. 2, II, 319, 1829, (*alosa*).
*Alausa*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XX, 389, 1847, (*vulgaris*).

Body deep, compressed, deeper than in related American genera, the head also deep, the free portion of the cheeks deeper than long; jaws wholly toothless; upper jaw with a sharp, deep notch at tip, the premaxillaries meeting at a very acute angle. Vertebræ 56 (in *Alosa alosa*), otherwise as in *Pomolobus*, to which genus *Alosa* is very closely allied. Species three, of the North Atlantic, ascending rivers; highly valued as food-fishes, although very full of small bones, the flesh white and rich, but not oily. (*Alosa*, Saxon *Allis*, old name of the European Shad, *Alosa alosa*.)

### 693. ALOSA SAPIDISSIMA (Wilson).

(COMMON SHAD; AMERICAN SHAD; NORTH RIVER SHAD; POTOMAC SHAD.)

Head 4¼; depth 3. D. 15; A. 21; lateral line 60; ventral scutes 21 + 16. Body comparatively deep. Mouth rather large, the jaws about equal, the lower fitting into a notch in the tip of the upper; no teeth. Preorbital moderate; cheeks much deeper than long, the preopercle extending little forward, joining the mandible at a point rather behind the eye. Gill rakers extremely long and slender, much longer than eye, about 60 below the angle of the arch, the number smaller in specimens from the Gulf of Mexico, which perhaps represent a tangible variety. Fins small; dorsal much nearer snout than base of caudal. Peritoneum white. Bluish above; sides white and silvery; a dark spot behind opercle, and sometimes several along the line dividing the color of the back from that of the sides; axil dusky. Length 2½ feet. Atlantic Coast of the United States from the Mirimachi to the Alabama, ascending rivers in spring to spawn. One of the most important of our food-fish, of most excellent flavor, though with many small bones. Also introduced by the United States Fish Commission on the Pacific Coast, where it is now abundant from Monterey northward. Specimens from the Gulf of Mexico are smaller, and have shorter and fewer gill rakers, constituting a slight variety. (*sapidissima*, most delicious.)

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* "Their judgment is by no means infallible, for I have had them frequently sort out into two piles, the fishes which they distinguish under these names, and found that their discrimination was not at all reliable. The features to which they mainly trust in the determination of *P. æstivalis* are the bluer color of the back and the greater serration of the ventral ridge," both of these characters varying with the condition of the specimen itself. (Goode.)

*Clupea sapidissima*, Wilson, in Rees's New Cyclopedia, IXG., no pagination nor date, but prior to 1812,* no locality, but probably Philadelphia; Rafinesque, Amer. Month. Mag., Vol. II, 1817, 205, tributaries of Atlantic Ocean; Jordan & Gilbert, Synopsis, 267, 1883.
*Clupea indigena*, Mitchill, Trans. Lit. & Phil. Soc. N. Y., I, 1815, 454, (very young), New York.
*Alosa præstabilis*, De Kay, New York Fauna: Fishes, 255, pl. 15, fig. 41, 1842, New York.
*Alosa sapidissima*, of many American writers.

## 210. SARDINELLA, Cuvier & Valenciennes.

### (Scaled Sardines.)

*Sardinella*, Cuvier & Valenciennes, Hist. Nat. Poiss., XX, 261, 1847, (*aurita*).
*Harengula*, Cuvier & Valenciennes, Hist. Nat. Poiss., XX, 280, 1847, (*latula*).
*Clupeonia*, Cuvier & Valenciennes, Hist. Nat. Poiss., XX, 345, 1847, (*jussieui*).
*Kowala*, Cuvier & Valenciennes, Hist. Nat. Poiss., XX, 362, 1847, (*thoracata* = *kowal*).
*Lile*, Jordan & Evermann, new subgenus, (*stolifera*).

Small herrings of the tropical seas, with the vertebræ in reduced number, about 40 to 44, and with the scales large, usually firm and adherent, often crossed by vertical striæ. Ventral scutes strong, 25 to 35 in number. Adipose eyelid obsolete. Lower jaw projecting; upper jaw somewhat emarginate; teeth weak. Ventrals inserted behind front of dorsal. Body compressed; cheeks not deep; gill rakers long and numerous; otherwise essentially as in *Pomolobus*. The genus *Sardinella*, as here understood, covers a wide diversity of forms and may be divisible into several genera when the anatomy of the species is better known. (*Sardinella*, diminutive of *Sardina*, a sardine.)

*a.* Side of body without distinct silvery lateral band; mouth moderate, the teeth very small, but permanent over most of the bones of the mouth; scales large and usually firm.
SARDINELLA:
  *b.* Ventral scutes 33 to 35.
    *c.* Body slender, the depth about 4½ in length; a black opercular spot. ANCHOVIA, 694.
    *cc.* Body rather deep, the depth about 3½ in length; no black opercular spot. CLUPEOLA, 695.
  *bb.* Species imperfectly described, probably allied to *Sardinella*.
    *d.* Snout and chin black. APICALIS, 696.
    *dd.* Snout and chin not black; a black humeral spot; sides with dark streaks. BISHOPI, 697.
HARENGULA (diminutive of *Harengus*, herring):
  *bbb.* Ventral scutes 25 to 28; body short and deep, compressed, the scales usually with vertical striæ.
    *e.* Scales not very firm and little adherent, so that many are lost in preserved examples; each scale with four vertical wavy striæ; ventral scutes about 15 + 10; depth 3⅖ in length; eye 2½ in head; no humeral spot. SARDINA, 698.
    *ee.* Scales firm and closely adherent so that few, if any, are lost in preserved examples; usually a humeral spot.
      *f.* Body moderately elongate, the ventral outline not strongly arched, the depth 3⅓ to 3⅖ in length.
        *g.* Head long, $3\frac{3}{7}$ in length; eye 2⅔ in head. MACROPHTHALMUS, 699.
        *gg.* Head deep, 4 in length; eye 3 in head. THRISSINA, 700.
      *ff.* Body deep, the ventral outline arched, forming an even curve from snout to vent, the depth 2¾ to 3; head 3⅕ in length; eye 2⅔ in head. HUMERALIS, 701.

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* Dr. Gill writes "The copy I have before me is in the original binding and has 'Thomas Munroe's Book 1812' on fly leaf."

LILE (Matti-lile, an Indian name given in Pondicherry to *Clupea lile*):

*aa.* Sides with a very distinct lateral silvery band; scales very firm, without vertical striæ; mouth very small, almost vertical; teeth small, none on vomer; tip of snout, chin, and upper fins dusky. STOLIFERA, 702.

### Subgenus SARDINELLA.

#### 694. SARDINELLA ANCHOVIA (Cuvier & Valenciennes).

Head about 4½; depth 4½. D. 16; A. 16. Body elongate and slender. Scales smooth, large, striated. Suborbital bones finely venulose; teeth on tongue and palatines, none on vomer; jaws mostly toothless. Dorsal nearer snout than root of caudal, the ventrals inserted below its middle. A black spot on opercle above. Martinique to Brazil; said to be closely allied to the European *Sardinella aurita*, also a little known species; apparently recognizable by the opercular spot. (Cuvier & Valenciennes.) (*Anchovia*, anchovy.)

*Sardinella anchovia*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XX, 269, 1847, Rio Janeiro; Martinique.
*Clupea anchovia*, GÜNTHER, Cat., VII, 421, 1868.

#### 695. SARDINELLA CLUPEOLA (Cuvier & Valenciennes).

(CAILLEU.)

Head 4 in total length with caudal; depth 4. D. 18; A. 18. Ventral scutes 33. Head short; profile of back straightish; snout rather long and blunt. Last rays of dorsal very short; ventrals under seventh dorsal ray. Scales very solid, striate; serrations of belly less strong than in some species. Steel-blue above, silvery below; the back with traces of longitudinal streaks; yellow blotch in life behind opercle. Guadeloupe; a food-fish of delicate flavor. (Cuvier & Valenciennes.) A little known species, not recognized by late writers, identified by Poey with *Sardinella humeralis* and later by Jordan with *Sardinella sardina*, but different from either if the above description is trustworthy;* the ventral scutes more numerous. (Diminutive of *Clupea*, herring.)

*Harengula clupeola*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XX, 289, 1847, Guadeloupe.

#### 696. SARDINELLA APICALIS (Müller & Troschel).

D. 18; A. 17. Lower jaw longer than upper; maxillary reaching first third of eye, which is more than half head. Ventrals under middle of dorsal. Scales large, forming nine rows on each side of body. Scales silvery, each one on belly with a copper-colored spot; point of snout above and beneath, black; a small, black, longitudinal band on front and a black spot over each eye; tip of dorsal and edge of caudal black. Barbadoes. (Müller & Troschel.) A species of uncertain relations. (*apicalis*, of the apex, the tip of snout black.)

*Alosa apicalis*, MÜLLER & TROSCHEL, in Schomburgk's Hist. Barbadoes, 675, 1848, Barbadoes.
*Clupea apicalis*, GÜNTHER, Cat., VII, 441, 1868.

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*Possibly identical with *Clupea brasiliensis*, STEINDACHNER, Ichth. Beitr., VIII, 64, 1879, Rio Janeiro; name preoccupied, changed to *Clupea janeiro*, EIGENMANN & BRAY, Ann. N. Y. Ac. Nat. Sci., 1894, 626.

### 697. SARDINELLA BISHOPI (Müller & Troschel).

Allied to *Sardinella apicalis*, but with a black spot behind operculum and no black on dorsal; sides with faint dark streaks; eye large, half height of head; 11 rows of scales on each side. Barbadoes. (Müller & Troschel.) A doubtful species, of uncertain relations. (A personal name.)

*Alosa bishopi*, MÜLLER & TROSCHEL, in Schomburgk's Hist. Barbadoes, 675, 1848. Barbadoes.

## Subgenus HARENGULA, Cuvier & Valenciennes.

### 698. SARDINELLA SARDINA (Poey).

(SARDINA DE LEY.)

Head $3\frac{4}{7}$; depth $3\frac{1}{3}$ to $3\frac{1}{2}$. D. 15; A. 18; scales 36; scutes 15 + 10. Head $1\frac{1}{10}$ in depth of body. Eye very large, $\frac{1}{3}$ longer than snout, $2\frac{1}{2}$ in head. Body rather elongate, the ventral outline little convex, forming a weak arch. Scales less firm and less adherent than in other species of *Harengula*, many of them lost in museum or market specimens; each scale with four vertical wavy striæ on its free edge. Insertion of dorsal nearly midway between snout and base of caudal. Color pale; no black humeral spot; trunk with longitudinal streaks; an orange area behind opercle in life; tips of dorsal and anal dusky. Length 8 inches. West Indian fauna; abundant; north to Key West. (*Sardina*, sardine.)

*Harengula sardina*, POEY, Memorias, II, 310, 1860, Cuba.
*Harengula callolepis*, GOODE, Proc. U. S. Nat. Mus., 1879, 152, Bermuda.
*Harengula clupeola*, JORDAN, Proc. U. S. Nat. Mus., 1889, 646; not of CUVIER & VALENCIENNES.

### 699. SARDINELLA MACROPHTHALMUS (Ranzani).

Head $3\frac{3}{7}$; depth $3\frac{2}{5}$; eye $2\frac{2}{3}$. D. 17; A. 18; scales 40–12; vertebræ 40. Body moderately elongate, the ventral outline little convex, forming a weak arch; length of head 1 to $1\frac{1}{5}$ in depth of body; eye large, $\frac{1}{5}$ longer than snout; insertion of ventrals nearly midway between snout and base of caudal. Bluish above, sides silvery; dark humeral spot usually evident, sometimes wanting; above this a dark line extends, bounding the dark of the back, above this a pale streak; caudal dusky. Scales less striate than in *S. humeralis*. West Indies, Cuba to Brazil; not very common. (μακρός, large; ὀφϑαλμός, eye.)

*Clupea macrophthalma*, RANZANI, Nov. Comm. Ac. Sci. Bonon., V, 320, 1842, Brazil; GÜNTHER, Cat., VII, 421, 1868.
*Harengula maculosa*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XX, 292, 1847, Martinique.
*Harengula jaguana*, POEY, Repertorio, I, 190, 1866, Jagua, Cuba, near Cienfuegos.
*Harengula macrophthalma*, JORDAN, Proc. U. S. Nat. Mus., 1889, 646.

### 700. SARDINELLA THRISSINA (Jordan & Gilbert).

Head 4; depth $3\frac{1}{3}$; eye 3. D. 15; A. 13; scales 40–10. Scutes 16 + 13. Body deep, but less so than in *S. humeralis*. Head large, rather blunt; mouth moderate, the lower jaw projecting, the upper jaw scarcely emarginate; maxillary 2 in head, reaching past front of pupil. Both jaws with small teeth; teeth on palatines, pterygoids, and tongue. Eye large. Cheeks and opercles with fine but distinct branching striæ. Gill rakers short, close-set, 30 below angle, the longest half eye. Scales firm and adherent, the edge roughened; scales before dorsal similar but smaller. Belly sharply compressed, with strong scutes. Ventrals 2 in head; pectorals 1⅓. Bluish above, silvery below; a round black humeral spot; fins pale. Length 8 inches. Gulf of California, rather rare. (Diminutive from *Thrissa*, *ϑρίσσα*, a herring or sardine, from the hair-like bones; *ϑρίξ*, a hair.)

*Clupea thrissina*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 353, Cape San Lucas. (Type, Nos. 6388, 2524, and 6339. Coll. Xantus.)

### 701. SARDINELLA HUMERALIS (Cuvier & Valenciennes).

(Sardina Escamuda; White-bill; Pincers.)

Head 3⅘; depth 2¾ to 3, the Florida specimens (var. *pensacolæ*) averaging 2¾; Cuban examples about 3; eye 2⅔. D. 16; A. 17; scales 40; scutes 16 + 12. Body deep, with the ventral outline forming an even curve from chin to vent. Eye moderate, ⅓ longer than snout. Insertion of ventrals nearer tip of snout than base of caudal. Teeth in jaws small; a large patch on tongue. Scales very adherent, each with one to four vertical curved striæ, those before dorsal more or less laciniate. Silvery, dark humeral spot usually present, but often obscure or wanting; surrounded by golden in life; usually a row of dark points extending backward from it along upper parts of body; no distinct longitudinal streaks. Length 8 inches. West Indies and Gulf of Mexico. Abundant from Pensacola and Cedar Keys southward; the specimens from Florida deeper than others, representing a northern variety or subspecies *pensacolæ*. (*humeralis*, pertaining to the shoulder.)

*Harengula humeralis*, Cuvier & Valenciennes, Hist. Nat. Poiss., xx, 293, 1847, Rio Janeiro; Bahia; Guadeloupe; San Domingo.

*Alausa striata*, Cuvier & Valenciennes, *l. c.*, xx, 429, 1847, Guadeloupe; Bahia.

*Harengula pensacolæ*, Goode & Bean, Proc. U. S. Nat. Mus., 1879, 152, Pensacola, Florida. (Type, Nos. 22831 and 22829. Coll. Stearns.) Jordan & Gilbert, Synopsis, 268, 1883.

*Clupea humeralis*, Günther, Cat., vii, 422, 1868.

*Harengula arcuata*, Jordan, Proc. U. S. Nat. Mus., 1889, 646.*

### Subgenus LILE, Jordan & Evermann.

### 702. SARDINELLA STOLIFERA, (Jordan & Gilbert).

Head 4¾; depth 3⅓; eye 2⅘. D. 14; A. 16; scales 40-11; scutes 17 + 12 = 29. Vertebræ 20 + 22 = 42, the membrane covering the vertebræ silvery. Body deep, much compressed, the belly strongly arched; the greatest depth just before dorsal. Head short; preopercle vertical. Mouth very small, very oblique, almost vertical, the maxillary reaching front of pupil; lower jaw longer, the upper scarcely emarginate. Both jaws with a few very small, weak teeth; a linear patch on tongue; none on vomer or palatines. Gill rakers slender, numerous, the longest ⅗ eye, about 29 below angle. Eye large, longer than snout. Dorsal fin inserted nearer snout than base of caudal, the ventrals under its first ray; anal short and low; pectorals 1⅓ in head; ventrals 1⅔. Scales smooth, firm, closely adherent, entire-edged, without striæ; a very narrow sheath of scales along dorsal and anal; caudal scaled half its length. Ventral scutes strongly developed, with strong spines. Translucent greenish, sides silvery, each scale with its marginal half punctate; a dark line along middle of back; snout and tip of lower jaw dusky; side with a very bright, well-defined silvery band, as in *Stolephorus*, margined by bluish above; the band widest mesially, as wide as a scale, a little wider than pupil; at base of caudal the band expands abruptly; tips of dorsal and caudal lobes jet-black. Length 6 inches. Gulf of California to Panama; abundant about Mazatlan; a beautiful and well-marked species, and a very delicate food-fish, allied to the genus *Pellonula*, and to the East Indian species *Clupea lile*, which belongs to the same subgenus (*Lile*). (*stolifer*, bearing a stole, or white zone.)

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* This species is probably not identical with *Clupea arcuata*, Jenyns, Ichth. Voy Beagle, 134, 1842, from Bahia Blanca, Patagonia.

*Clupea stolifera*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1881, 339, Mazatlan. (Type, No. 28125. Coll. Gilbert.)

## 211. OPISTHONEMA, Gill.

### (THREAD HERRING.)

*Opisthonema*, GILL, Proc. Ac. Nat. Sci. Phila., 1861, 37, (*thrissa* = *oglinum*).

Characters essentially those of *Sardinella*, except that the last ray of the dorsal is produced in a long filament as in *Dorosoma*, *Megalops*, and *Tarpon*. Species few, American. (*ὄπισϑε*, behind; *νῆμα*, a thread.)

*a*. Head 4 to 4½ in length; depth about 3½; anal rays about 23; sides of back with dark spots. OGLINUM, 703.

*aa*. Head larger, 3⅖ to 3⅚ in length; depth 3 to 3½; anal rays about 20; back without dark spots. LIBERTATE, 704.

### 703. OPISTHONEMA OGLINUM (Le Sueur).

(THREAD HERRING; MACHUELO; CAILLEU-TASSART; SPRAT.)

Head 4⅓; depth 3½. D. 19; A. 24; lateral line 50; scutes 17 + 14. Body oblong, compressed, formed as in *Harengula*, the belly strongly serrate. Tongue with minute teeth; jaws toothless, lower jaw slightly projecting; maxillary reaching nearly to middle of orbit. Gill rakers very long and slender. Dorsal fin inserted in front of ventrals, much nearer snout than base of caudal; dorsal filament about as long as head; anal very low; paired fins small. Scales smooth, rather firm, but easily detached, much as in *Sardinella sardina*. Bluish above, silvery below; an indistinct bluish shoulder spot; each scale on the back with a dark spot, these forming longitudinal streaks. Length 12 inches. West Indian fauna; regularly northward to Florida and Carolina, occasionally straying much farther (Longport, New Jersey, Bean; and Fortress Monroe, Kendall). Abundant in the tropics. (Name unexplained, unless from the word *ogle*, in allusion to the large eyes.)

*Clupea thrissa*, BROUSSONET, Ichthyologie, fasc. I, 1782, Carolina; Jamaica; not of Osbeck, 1757, which is a Chinese species of *Dorosoma*; GÜNTHER, Cat., VII, 432, 1868, and of many authors.

*Megalops oglina*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., I, 1817, 359, Newport, Rhode Island.

*Megalops notata*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., I, 1817, 359, Guadeloupe.

*Chatoëssus signifer*, De Kay, N. Y. Fauna: Fishes, 264, 1842, New York.
*Chatoëssus eumorphus*, Gosse, Naturalist's Sojourn in Jamaica, 290, 1851, Jamaica.

### 704. OPISTHONEMA LIBERTATE (Günther).

(Sardina Machete.)

Head 3⅔ to 4; depth 3 to 3½. D. 17; A. 19; scales 48. Similar to *Opisthonema oglinum*, the head longer, the gill rakers longer and more numerous. Bluish above, silvery on sides and below, a yellowish streak on level of orbit; an indistinct dark spot on opercle, and a larger humeral spot; no dark spots on side of back; caudal tipped with jet-black; tip of snout and lining of opercle black. Pacific coast of Mexico and Central America, abundant, especially in the Gulf of California. (Name from Libertad, port of San Salvador, where the type was taken.)

*Meletta libertatis*, Günther, Proc. Zool. Soc. Lond., 1866, 603, Libertad, Central America.
*Clupea libertatis*, Günther, Cat., vii, 433, 1868.
*Opisthonema libertate*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 622.
*Opisthonema libertatis*, Evermann & Jenkins, Proc. U. S. Nat. Mus., 1891, 134.

## 212. BREVOORTIA, Gill.

(Menhadens.)

*Brevoortia*, Gill, Proc. Ac. Nat. Sci. Phila., 1861, 37, (*menhaden*).

Body elliptical, compressed, deepest anteriorly, tapering behind. Head very large; cheeks deeper than long. Mouth large, the lower jaw included; no teeth; gill rakers very long and slender, densely set, appearing to fill the mouth when it is opened; gill arches angularly bent. Scales deeper than long, closely imbricated, their exposed edges vertical and fluted or pectinated. Dorsal fin low, rather posterior; anal fin small. Intestinal canal elongate. Vertebræ 48. Peritoneum dusky. Species few; inhabiting the Atlantic; spawning probably in brackish water in the spring. Coarse, herbivorous fishes, not valued as food, but the young of the greatest value as food to other fishes. (Dedicated to James Carson Brevoort, of Brooklyn, a gentleman long interested in the study of fishes.)

### 705. BREVOORTIA TYRANNUS (Latrobe).

(Menhaden; Mossbunker; Bony-fish; Whitefish; Bugfish; Fatback; Pogy.)

Head 3⅕; depth 3. D. 19; A. 20; lateral line 60 to 80; ventral plates 20 + 12. Head rather short and heavy. Fins comparatively short, the height of the dorsal less than the length of the maxillary; height of anal less than half the length of the maxillary. Pectorals not reaching to ventrals; dorsal inserted slightly behind ventrals, about midway between snout and base of caudal. Scales moderate, strongly serrated, arranged very irregularly, those before dorsal strongly pectinate. Operculum strongly striated or almost smooth (var. *aurea*). Gill rakers much longer than eye. Bluish above; sides silvery, with a strong brassy luster; fins usually yellowish; a conspicuous dark scapular blotch, behind which are often smaller spots. Length 18 inches. Nova Scotia to Brazil; very abundant southward; herbivorous, running in schools, probably spawning in brackish water. Held in no esteem as a food-fish, but very valuable for oil and manure. (*tyrannus*, *τύραννος*, ruler.*)

*Clupea tyrannus*, LATROBE, Trans. Amer. Phil. Soc. Phila., V, 1802, 77, pl. 1, Chesapeake Bay.
*Clupea menhaden*, MITCHILL, Trans. Lit. and Phil. Soc. N. Y., I, 1815, 453, New York; GÜNTHER, Cat., VII, 436, 1868.
*Clupea neglecta*, RAFINESQUE, Amer. Monthly Mag., 1818, 206, Long Island.
*Clupea carolinensis*, GRONOW, Cat. Fishes, 140, 1854, South Carolina.
*Alosa menhaden*, STORER, Hist. Fishes Mass., 337, 1867.
*Brevoortia tyrannus*, GOODE, Proc. U. S. Nat. Mus., I, 1878, 531; GOODE, Rept. U. S. Fish Comm., V, 1877 (1879), 19; complete biography; JORDAN & GILBERT, Synopsis, 269, 1883.

Represented on the coast of Brazil by

### 705a. BREVOORTIA TYRANNUS AUREA (Agassiz).

Opercles almost smooth; head rather shorter, jaws shorter and body deeper, the scales more regularly arranged than in *Brevoortia tyrannus*. Coast of Brazil. (*aureus*, golden.)

*Clupanodon aureus*, AGASSIZ, Spix, Pisc. Brasil, 52, 1828, Brazil.
*Clupea aurea*, GÜNTHER, Cat., VII, 437, 1868.

Occasional specimens taken along the Atlantic Coast of the United States represent

### 705b. BREVOORTIA TYRANNUS BREVICAUDATA, Goode.

Similar to *aurea*, but the jaws and caudal shorter, the latter not longer than pectorals. Noank, Connecticut, and south. (Goode.) (*brevis* short; *caudatus*, tailed.)

*Brevoortia tyrannus brevicaudata*, GOODE, Proc. U. S. Nat. Mus., 1878, 34, Noank, Connecticut. (Type, No. 14846, *a. b.* Coll. Goode.)

The common form on the coast of the Gulf of Mexico is

### 705c. BREVOORTIA TYRANNUS PATRONUS, Goode.

(GULF MENHADEN.)

Head 3; depth 2⅗. D. 19; A. 22; lateral line 50 to 65. Head larger than in *B. tyrannus*; fins long, the height of the dorsal greater than the length of the maxillary; that of the anal more than half the height of the maxillary. Pectorals reaching beyond front of ventrals; insertion of dorsal in front of ventrals, just behind the middle point between the snout and the base of the caudal. Scales moderate, with their margins entire, fluted. Axillary appendages large; large scales at base of pectoral. Operculum delicately striated. Greenish-gray above; sides silvery, with brassy luster; scapular blotch inconspicuous. Gulf of Mexico, generally abundant on the Florida Coast, apparently varying into *B. tyrannus*. (*patronus*, patron, in allusion to the ever present Crustacean, *Cymothoa prægustator*.)

*Brevoortia patronus*, GOODE, Proc. U. S. Nat. Mus., I, 1878, 39, Brazos, Santiago. (Type, No. 892, *a. b.*). GOODE, Rept. U. S. Fish Comm., V, 1877 (1879), 19; JORDAN & GILBERT, Synopsis, 269, 1883.

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* A parasitic Crustacean (*Cymothoa prægustator*, LATROBE) is found in the mouths of a very large proportion of the individuals of this species. The specific names both of the fish and the Crustacean refer to this peculiarity, the ancient Roman rulers (*tyranni*) having had their tasters (*prægustatores*) to taste their food before them to prove its harmlessness, thus to prevent poisoning.

## 213. CHIROCENTRODON, Günther.

*Chirocentrodon*, GÜNTHER, Cat., VII, 463, 1868, (*tæniatus*).

Body oblong, much compressed, covered with deciduous scales. Belly weakly serrated, the serræ beginning at the thorax. Lower jaw projecting; teeth strong, a pair of strong canines in front of each jaw; evident teeth on maxillary; narrow bands on vomer, palatines, pterygoids, and tongue. Anal long, of about 40 rays; dorsal opposite anal; ventrals very small; caudal forked. Branchiostegals 6, short and broad. One species. (*χείρ*, hand; *κέντρον*, spine; *ὀδούς*, tooth.)

### 706. CHIROCENTRODON TÆNIATUS, Günther.

Head $4\frac{1}{4}$; depth $4\frac{2}{3}$; eye $3\frac{1}{2}$. D. 15; A. 41. Snout compressed, longer than eye. Maxillary large, reaching to behind margin of eye. Gill rakers fine, nearly as long as eye, 10 + 17 in number. Dorsal inserted behind front of anal, midway between occiput and root of caudal; ventrals not longer than eye; pectorals nearly as long as head without snout. Serrature of abdomen not prominent; 11 scutes behind ventrals. White, with a narrow silvery, lateral band. Jamaica. (Günther.) Not seen by us. (*tæniatus*, striped.)

*Chirocentrodon tæniatus*, GÜNTHER, Cat., VII, 463, 1868, Jamaica. (Coll. Dr. Parnell.)

## 214. ILISHA, Gray.

*Platygaster*, SWAINSON, Classif. Anim., II, 294, 1839, (*africanus*); name preoccupied.

*Ilisha* (GRAY) RICHARDSON, Ichthyol. China, in Proc. Brit. Assoc., 1845 (1846), 306, (*abnormis*); no description.

*Pellona*,* CUVIER & VALENCIENNES, Hist. Nat. Poiss., XX, 300, 1847, (*orbignyana* = *flavipinnis*).

*Ilisha*, BLEEKER, Ned. Tydskr. Dierk., 300, 1866, (*abnormis*).

Body much compressed, the thorax and abdomen strongly serrated. Scales moderate. Lower jaw prominent; mouth moderate, with rasplike bands of minute teeth on jaws, palatines, pterygoids, and tongue; none on vomer. Anal fin very long; ventrals present, small, inserted before the small dorsal; upper ray of pectoral strong; caudal deeply forked. Tropical coasts of America and Asia. (*Ilisha*, an East Indian name of *Sardinella lisha*.)

*a.* Anal rays 40 to 45; anal placed behind dorsal.
    *b.* Dorsal rays 19 or 20; eye 4 in head. FLAVIPINNIS, 707.
    *bb.* Dorsal rays 15; eye $3\frac{1}{2}$ in head. BLEEKERIANA, 708.
*aa.* Anal rays about 50.
        *c.* Depth less than one-third length; the ventral outline weakly arched; anal placed behind dorsal. PANAMENSIS, 709.
        *cc.* Depth more than one-third length, the ventral outline strongly arched; anal partly below dorsal. FURTHI, 710.

### 707. ILISHA FLAVIPINNIS (Valenciennes).

Head $3\frac{4}{5}$; depth $3\frac{2}{5}$; eye 4. D. 19 or 20; A. 40; scales 65–18. Posterior halves of ridges on upper side of head distinctly convergent anteriorly, very slightly so posteriorly. Insertion of dorsal midway between end of snout and root of caudal. Base of anal 3½ in length; ventrals longer than eye. Coast of Surinam and Brazil. (Günther.) (*flavus*, yellow; *pinna*, fin.)

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* *Pellona* is the Spanish name of *Pellona flavipinnis* at Buenos Ayres, apparently from *pelon*, bald, in allusion to the caducous scales.

If "typonyms," or new generic names based on the indication of a type, without description, are to be rejected, the name *Pellona* should take the place of *Ilisha*.

*Pristigaster flavipinnis*, Valenciennes, in D'Orbigny, Voy. Amer. Mér., Poiss., pl. x, fig. 2, 1839, Buenos Ayres.

*Pellona orbignyana*, Cuvier & Valenciennes, Hist. Nat. Poiss., xx, 302, 1847; same type.

? *Pellona castelnæana*, Cuvier & Valenciennes, Hist, Nat. Poiss., xx, 306, 1847, Mouth of Amazon; (D. 19; A. 36 to 38).

*Pellona flavipinnis*, Günther, Cat., vii, 454, 1868.

### 708. ILISHA BLEEKERIANA (Poey).

(Anchoa Pelada.)

Depth 5⅔ in length with caudal; eye 3½. D. 15; A. 43; scutes 25. Ventral line strongly curved. Mouth wide, oblique. Anal placed behind dorsal; length of anal equal to its distance from posterior border of eye. Scales very caducous. Silvery. Matanzas, Cuba; rare. (Poey.) Perhaps not distinct from *I. flavipinnis*. (Named for Dr. Pieter van Bleeker, surgeon in the Dutch Indies, the most indefatigable worker who has yet appeared in ichthyology; author of very many papers on East Indian fishes.)

*Pellona bleekeriana*, Poey, Repertorio, ii, 242, 1867, Matanzas.

### 709. ILISHA PANAMENSIS (Steindachner).

Head 3¾; depth 3⅙ to 3⅖; eye 3⅖ to 3⅚. D. 16; A. 50; scales 58–21; scutes 22 + 12. Ventral line very weakly curved. Mouth very oblique. First ray of anal under last of dorsal, which is ⅗ of the eye's diameter nearer snout than base of caudal. Silvery, with yellowish fins. Length 16 inches. Panama; not rare.

*Pellona panamensis*, Steindachner, Ichth. Beitr., i, 14, 1874, Panama.

### 710. ILISHA FURTHI (Steindachner).

Head 3¾ to 4; depth 2⅔ to $2\frac{6}{7}$; eye 3 to 3⅖. D. 16; A. 50; Scales 55; scutes 23 + 12. Ventral line very strongly curved. Mouth very oblique. First 5 to 7 rays of anal below dorsal, which is inserted an eye's diameter nearer snout than base of caudal. Silvery, fins yellow, more or less punctate. Length a foot. Panama; not rare. (Named for Ignatius Fürth, Austrian Consul at Panama.)

*Pellona fürthi*, Steindachner, Icth. Beitr., i, 14, 1874, Panama.

## 215. OPISTHOPTERUS, Gill.

*Opisthopterus*, Gill, Proc. Ac. Nat. Sci. Phila., 1861, 31, (*tartoor*).

Body elongate, very much compressed, with the abdomen prominent and strongly serrated. Scales thin, deciduous, of moderate size. Lower jaw projecting; maxillary not produced; teeth rather small, in villiform bands on both jaws, palatines, pterygoids, and tongue; vomer toothless. Dorsal fin small, inserted considerably behind middle of body; behind front of anal; anal fin very long; ventrals wanting; caudal deeply forked. Tropical parts of the Pacific. (ὄπισϑε, behind; πτερόν, fin, the dorsal being placed farther backward than in *Pristigaster*.)

*a.* Anal rays 53; eye 2¾ in head. LUTIPINNIS, 711.
*aa.* Anal rays 56; eye 3½ in head; dorsal nearer root of caudal than scapula. DOVII, 712.
*aaa.* Anal rays 61, eye 3 in head; dorsal midway between scapula and root of caudal. MACROPS, 713.

### 711. OPISTHOPTERUS LUTIPINNIS (Jordan & Gilbert).

Head 4½; depth 3½; eye 2⅘. D. 13; A. 53; scales 44-11; scutes 29. Body elongate, strongly compressed, anterior profile straight. Mouth large, very oblique, the lower jaw longest; maxillary a little more than half head. Teeth rather strong, present on most bones of the head except the vomer. Eye very large. Gill rakers about 18, not longer than pupil. Dorsal small, posterior, slightly nearer base of caudal than occiput; pectorals long, nearly as long as head; anal moderate. Scales thin, deciduous; ventral scutes very strong. Greenish, sides golden-silvery, fins mostly yellow; a black spot on preopercle and a very distinct humeral spot. Length 6 inches. Pacific coast of Mexico, rather scarce at Mazatlan. (*luteus*, yellow; *pinna*, fin.)

*Pristigaster lutipinnis*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1881, 340, Mazatlan. (Type, Nos. 28126, 28209, and 28320. Coll. Gilbert.)

### 712. OPISTHOPTERUS DOVII (Günther).

Head 4⅘; depth 3½; eye 3½. D. 11; A. 56; scales 51-13. Maxillary less than half head, its supplemental bone moderate, reaching end of the bone. Insertion of dorsal considerably nearer root of caudal than scapula. Panama. (Günther.) (Named for Capt. John M. Dow, formerly resident at Panama, and who made large collections of fishes for the British Museum and for the Smithsonian Institution.)

*Pristigaster dovii*, GÜNTHER, Cat., VII, 461, 1868, Panama. (Coll. Capt. Dow.)

### 713. OPISTHOPTERUS MACROPS (Günther).

Head 4½; depth 3; eye 3. D. 13; A. 61; scales 53-17. Dorsal inserted midway between scapula and root of caudal. Maxillary less than half head, its supplementary bone narrow, extending to its extremity. Silvery, scapula black. Panama. (Günther.) (μακρός, large; ὤψ, eye.)

*Pristigaster macrops*, GÜNTHER, Proc. Zool. Soc., 1866, 603, and Cat., VII, 461, 1868, Panama. (Coll. Salvin.)

## 216. ODONTOGNATHUS, Lacépède.

*Odontognathus*, LACÉPÈDE, Hist. Nat. Poiss., II, 221, 1799, (*mucronatus*).
*Gnathobolus*, BLOCH & SCHNEIDER, Syst. Ichth., 556, 1801, (*mucronatus*).

Body rather elongate, compressed, covered with caducous scales. Ventral outline not prominent, covered with sharp scutes. Dorsal fin small, much behind front of the long anal. Maxillary very long, in the adult, extending beyond eye, shorter in the young. Teeth small. One species known. (ὀδούς, tooth; γνάθος, jaw.)

| | |
|---|---|
| *a.* Anal rays about 76; scutes on belly 8 + 12. | MUCRONATA, 714. |
| *aa.* Anal rays about 67; scutes on belly 13 + 16. | PANAMENSIS, 715. |

### 714. ODONTOGNATHUS MUCRONATA, Lacépède.

Head 5; depth 4⅜. D. 11 or 12; A. 74 to 82; scutes 8 + 12. Eye as long as snout, 3½ in head in young. Maxillary tapering, extending in the adult at least as far as interopercle, shorter and truncate in young. Insertion of dorsal twice as far from eye as from base of caudal. Coast of Guiana. (Günther.) (*mucronatus*, with sharp points.)

*Odontognathus mucronatus*, LACÉPÈDE, Hist. Nat. Poiss., 221, pl. 7, fig. 2, 1799, Cayenne.
*Gnathobolus mucronatus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XXI, 91, 1848.
*Pristigaster mucronatus*, GÜNTHER, Cat., VII, 462, 1868.

### 715. ODONTOGNATHUS PANAMENSIS (Steindachner).

Head 5½; depth nearly 4. D. 12; A. 67; scales 55 or 56. Eye equals snout, 3¾ in head. Body very slender and compressed. Upper profile of head strongly concave; dorsal line before dorsal arched; ventral outline strongly arched; base of anal straight. Mouth oblique; maxillary produced in a slender process, which reaches beyond gill opening; a thin accessory bone, with a bluntish keel on the maxillary, half hidden when the mouth is closed. Teeth small, short, mostly in one row. Top of head narrow, with five ridges. Pectoral longer than head by an eye's diameter, the first ray broad. Dorsal small, twice as far from gill opening as from base of caudal; caudal as long as head; ventral scutes 13 + 16; scales caducous. Panama. Length 8 inches. (Steindachner.)

*Pristigaster (Odontognathus) panamensis*, STEINDACHNER, Ichth. Beitr., v, 24, 1876, Panama.

## 217. PRISTIGASTER, Cuvier.

*Pristigaster*, CUVIER, Règne Animal, Ed. 1, 176, 1817, (*cayanus*).

This genus differs from *Opisthopterus* in the deeper body, the ventral ridge being very prominent and convex, and especially in the position of the dorsal. This fin is larger in *Pristigaster* than in related genera, and is inserted near the middle of the length of the body, before the anal. One species know, from South America. (*πρίστης*, a saw; *γαστήρ*, belly.)

### 716. PRISTIGASTER CAYANUS, Cuvier.

Head 4; depth 2. D. 15; A. 46 to 52. Front of dorsal much nearer tip of snout than base of caudal; upper caudal rays produced in filaments in adult, these longer than the fin itself. Abdominal profile subcircular in the adult. Scutes 32. Color silvery. Length 4 inches. Coast of Guiana and northern Brazil. (Cuvier & Valenciennes.) (*Cayanus*, from Cayenne.)

*Pristigaster cayanus*, CUVIER, Règne Animal, Ed. 1, pl. 10, fig. 3, 1817, Cayenne; CUVIER & VALENCIENNES, Hist. Nat. Poiss., XX, 334, 1847; GÜNTHER, Cat., VII, 463, 1868.
*Pristigaster martii*, AGASSIZ, Spix, Pisc. Brasil., 55, 1829, Brazil.
*Pristigaster phaëton*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XX, 338, 1847, mouth of Amazon.

## Family LXII. ENGRAULIDIDÆ.

### (The Anchovies.)

Body elongate, more or less compressed, covered with thin cycloid scales. Head compressed. Mouth extremely large, more or less oblique, usually overlapped by a pointed, compressed, pig-like snout. Gape very wide, the maxillary very long and slender, formed of about three pieces, extending backward far behind the eye; in some species beyond the head. Premaxillaries not protractile, very small, firmly joined to the maxillaries. Teeth usually small, sometimes obsolete, usually fine and even, in a single row in each jaw; canines sometimes present. Eye large, well forward, without adipose eyelid. Preorbital narrow. Opercles thin and membranaceous. Gill rakers long and slender. Branchiostegals slender, 7 to 14 in number. Gill membranes separate or joined, free from the isthmus. Pseudobranchiæ present. No lateral line. Belly rounded or weakly serrate. Fins various; the dorsal usually short and median; no adipose fin; caudal forked. Small, carnivorous shore fishes, usually swimming in large schools on sandy shores; abundant in all warm seas, occasionally entering rivers. Genera 9; species about 80. This group is often regarded as a subfamily under the *Clupeidæ*, from which it differs in no character of high importance.

(*Clupeidæ*, group *Engraulidina*, Günther, Cat. vii, 383–406, 1868.)

*a.* Teeth in the jaws equally small, if present; no canines.
*b.* Insertion of dorsal before that of anal.
*c.* Gill membranes nearly or quite separate, free from the isthmus.
*d.* Teeth present at all ages; maxillaries not greatly produced; no pectoral filaments.
*e.* Vertebræ about 41 in number; bones firm; species chiefly tropical. STOLEPHORUS, 218.
*ee.* Vertebræ about 45 in number; bones rather feeble; species of the temperate zones. ENGRAULIS, 219.
*dd.* Teeth wanting in the adult; minute, but present in the young; body very deep, but not strongly compressed. ANCHOVIA, 220.
*cc.* Gill membranes broadly united, free from the isthmus. CETENGRAULIS, 221.
*bb.* Insertion of dorsal behind front of the very long anal; gill membranes separate. PTERENGRAULIS, 222.
*aa.* Teeth in jaws unequal, some of them enlarged and canine-like. LYCENGRAULIS, 223.

## 218. STOLEPHORUS, Lacépède.

### (Silvery Anchovies.)

*Stolephorus*, Lacépède, Hist. Nat. Poiss., v, 381, 1803, (*japonica*).

Body oblong, compressed, covered with rather large, thin, deciduous scales. Belly rounded, or weakly compressed. Snout conical, compressed, projecting beyond the very large mouth. Maxillary narrow, little movable, usually formed of three pieces, extending backward far behind the eye, to the base of the mandible, or beyond, not beyond gill opening. Premaxillaries very small. Teeth small, subequal, present at all ages, usually on the jaws, vomer, palatines, and pterygoids. Anal fin moderate, free from caudal (its rays 12 to 40). No pectoral filaments.

Dorsal inserted about midway of body, posterior to ventrals. Pectorals and ventrals each with a large axillary scale. Adipose eyelid obsolete. Vertebræ* about 40 (40 to 42) in species examined. Flesh rather pale and dry, more or less translucent; the bones firm. Pseudobranchiæ present. Branchiostegals 9 to 14. Gill rakers long and slender. Gill membranes separate, free from the narrow isthmus. Species about 50; small, carnivorous shore fishes, swimming in large schools on sandy shores of all warm seas, occasionally entering rivers. Most of them are marked by a very broad, distinct, silvery band. (*στολή*, a stole, a white band worn by priests; *φόρος*, bearing; in allusion to the silvery lateral band.)

*a.* Anal rays 12 to 14; body very slender, the depth 6 in length; no distinct lateral band. MIARCHUS, 717.
*aa.* Anal rays 15 to 17; body slender, compressed, the depth 5 to 6 in length.
  *b.* Maxillary short, not quite reaching margin of preopercle; lateral band well defined, ¾ eye. PERFASCIATUS, 718.
  *bb.* Maxillary of moderate length, reaching beyond preopercle nearly to gill opening.
    *c.* Sides with a faint silvery streak; gill rakers short, the longest ½ eye; belly serrulate. EXIGUUS, 719.
    *cc.* Sides with a well-defined lateral silvery band; belly not serrulate.
      *d.* Eye 4 in head, as long as snout; scales caducous. CUBANUS, 720.
      *dd.* Eye 3⅓ in head, longer than snout; axillary sheaths very large. PERTHECATUS, 721.
      *ddd.* Eye 3¾ in head, longer than snout; scales not caducous. ISCHANUS, 722.
*aaa.* Anal rays 19 to 24.
  *e.* Side with a distinct silvery lateral band, with well-defined edges.
    *f.* Maxillary long, reaching past root of mandible, nearly or quite to gill opening; snout projecting considerably beyond lower jaw.
      *g.* Body moderately elongate, the depth 4 to 4¾ in length of body.
        *h.* Silvery lateral band very sharply defined, as broad as eye, not much narrowed anteriorly; eye large, 3½ in head; belly serrulate; A. 20; gill rakers ⅔ eye. BROWNII, 723.
        *hh.* Silvery lateral band narrow anteriorly, becoming as broad as eye opposite anal fin; belly compressed, not serrulate; anal rays 20. CULTRATUS, 724.
        *hhh.* Silvery lateral band throughout narrower than eye; anal rays 23; gill rakers nearly as long as eye. DELICATISSIMUS, 725.
      *gg.* Body more elongate, the depth about 5¼ in length of body; gill rakers as long as eye. A. 23 or 24; eye 4⅗ in head. CHŒROSTOMUS, 726.
    *ff.* Maxillary short, not reaching root of mandible; eye small, not longer than snout, 4 in head; silvery stripe rather diffuse, half broader than eye; body little compressed, approaching *Engraulis mordax* in form. ARGYROPHANUS, 727.
  *ee.* Sides without distinct silvery band, or with a faint diffuse streak.
    *i.* Opercles short, the distance from lower posterior angle of cheek to gill opening much less than from the same point forward to middle of eye; snout bluntish, not produced.
      *j.* Dorsal rays 11; depth 4⅔ in length; belly serrulate; anal 22 or 23. CURTUS, 728.
      *jj.* Dorsal rays 15 or 16; depth 4⅓ in length, pectorals longer; anal 23 or 24. POEYI, 729.
    *ii.* Opercle unusually long, the distance from lower posterior angle of cheek backward to gill opening as great as distance from same point forward to center of eye; cheeks very broad; snout projecting; eye 4 in head; anal 22. OPERCULARIS, 730.

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* In but few of the many species has the skeleton been examined. In general the bones are firmer, the vertebræ larger and less numerous than in *Engraulis*, but the value of this character is yet to be proved.

*aaaa.* Anal rays about 30, (25 to 36).

*k.* Silvery lateral band diffuse or obsolete ; body much compressed ; eye 3 to 3½ in head.

*l.* Gill rakers shorter than eye ; lateral band narrow.

*m.* Belly slightly serrulate ; gill rakers ⅔ eye ; scales caducous ; anal rays 25 or 26. MITCHILLI, 731.

*mm.* Belly not serrulate ; gill rakers half eye ; scales not caducous ; anal rays 27. LUCIDUS, 732.

*ll.* Gill rakers long and slender, longer than eye ; belly trenchant, not serrate ; scales 40 ; lateral band broad and diffuse or obsolete ; snout much projecting.

*n.* Snout moderately pointed ; minute teeth in both jaws ; lateral band diffuse. CLUPEOIDES, 733.

*nn.* Snout pointed ; minute teeth in upper jaw only ; lateral band obsolete. PRODUCTUS, 734.

*kk.* Silvery lateral band well defined ; snout short, little projecting.

*o.* Maxillary reaching little behind root of mandible ; scales 40 ; silvery lateral band as broad as eye ; gill rakers nearly as long as eye ; anal rays 31. COMPRESSUS, 735.

*oo.* Maxillary reaching gill opening ; scales 35 ; lateral band silver gray ; anal rays 31 to 36. PANAMENSIS, 736.

*aaaaa.* Anal fin extremely long, its rays 37 or 38.

*p.* Lateral band ill defined or obsolete ; snout pointed, much projecting ; insertion of dorsal nearer snout than base of caudal ; subopercle with a flat triangular prominence. SPINIFER, 737.

### 717. STOLEPHORUS MIARCHUS, Jordan & Gilbert.

Head 4⅕ ; depth 6. D. 11 to 13 ; A. 12 to 14. Very slender, little compressed, the belly not trenchant ; snout subconical, projecting. Teeth evident in both jaws ; maxillary short, reaching edge of preopercle. Eye not very large. Insertion of dorsal midway between snout and caudal ; anal very short, its first ray under last of dorsal. Scales caducous. Perfectly transparent in life, with some black dots ; a diffuse lateral silvery shade, but no stripe. Length 2 inches. Mazatlan to Panama ; abundant. At Mazatlan it is not taken in the Estuary with other *Stolephori*, but is taken with dynamite in deep water, where it swims near the surface. It is probable that the types are immature and are possibly the young of *S. exiguus*. Very young specimens taken at Key West and called the same by Jordan, are not this species ; they are either new or the young of *Stolephorus perfasciatus*. (μειόω, to reduce ; ἀρχός, anus.)

*Stolephorus miarchus*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1881, 344, Mazatlan. (Type, No. 28119. Coll. Gilbert.) JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 622.

### 718. STOLEPHORUS PERFASCIATUS (Poey).

Head 4¼ ; depth 6 ; eye 3½. D. 12 ; A. 14 to 16. Body rather elongate ; snout compressed and pointed, shorter than eye. Top of head with a slight keel. Maxillary and lower jaw finely toothed ; maxillary unusually short, its posterior end rounded, not extending quite to margin of preopercle ; gill rakers numerous ; pectoral 1¾ in head, not reaching ventrals ; insertion of anal below last rays of dorsal, the fin short ; origin of dorsal midway between root of caudal and pupil. Color of *S. brownii*, the lateral band rather narrower, well defined, its width about ¾ eye ; no dark punctulations except on base of caudal and sometimes on anal. Length 2 to 3 inches. Florida Keys to Cuba ; common, but much less abundant than *Stolephorus brownii*. (*perfasciatus*, well-banded.)

*Engraulis perfasciatus*, Poey, Memorias, II, 313, 1860, Cuba; Günther, Cat., VII, 391, 1868; not of Swain, Bull. U. S. Fish Comm., II, 1882, 55; not of Jordan & Gilbert, Synopsis, 273, 1883.

*Stolephorus perfasciatus*, Swain & Meek, Proc. Ac. Nat. Sci. Phila., 1884, 34.

### 719. STOLEPHORUS EXIGUUS, Jordan & Gilbert.

Head 3¾; depth 5; eye 3¼. D. 12; A. 17; scales 38–5. Body slender, not greatly compressed and not elevated; belly compressed, serrulate; head short; opercular margin not very oblique; cheek narrowly triangular; snout ⅗ eye, which is large; maxillary about reaching opercular margin, tapering to an acute point; teeth in both jaws. Gill rakers short, the longest ½ eye. Dorsal inserted midway between middle of pupil and base of caudal; pectorals not reaching ventrals. Scales caducous. Translucent, with dark dots; sides with a faint silvery streak. Length 2½ inches. Mazatlan; not common. (*exiguus*, thin.)

*Stolephorus exiguus*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1881, 342, Mazatlan. (Type, No. 28120. Coll. Gilbert.)

### 720. STOLEPHORUS CUBANUS (Poey).

(Bocon.)

Head 5 in length with caudal; depth 6⅔; eye 4. D. 14; A. 17. Allied to *S. brownii*, but with the anal shorter. Body slender, compressed. Eye as long as snout. Maxillary with teeth, its tip extending beyond the opercular border. Dorsal beginning midway between front of caudal and posterior edge of eye; pectoral not quite reaching ventral. Scales caducous. A silvery band ¼ depth of body. Length 2¾ inches. Cuba and Porto Rico. (Poey.)

*Engraulis cubanus*, Poey, Synopsis, 420, 1868, Cuba. (Coll. Poey.)

### 721. STOLEPHORUS PERTHECATUS, Goode & Bean.

Head 3⅔; depth 5; eye 3⅓. D. 11; A. 16; scales 38. Body somewhat compressed, the belly not carinated nor serrated. Eye longer than snout; snout conical; teeth minute, in both jaws; maxillary with acute tip almost reaching gill opening; gill rakers numerous, ⅔ eye. Dorsal inserted midway between center of eye and base of caudal; pectorals not quite reaching ventrals; axillary sheaths very large, almost as long as pectoral or ventral. Olivaceous, with a narrow silvery stripe, ¼ depth of body, not half as wide as eye. Length 3⅔ inches. Pensacola, Florida. (Goode & Bean.) Apparently allied to *S. perfasciatus*, but the maxillary longer. (*perthecatus*, well sheathed.)

*Stolephorus perthecatus*, Goode & Bean, Proc. U. S. Nat. Mus., 1882, 434, Pensacola. (Type, No. 30483. Coll. Stearns.)

### 722. STOLEPHORUS ISCHANUS, Jordan & Gilbert.

Head 3¾; depth 5. D. 13; A. 16; scales 40–7. Close to *Stolephorus brownii*, but slenderer and with fewer anal rays. Body elongate, not strongly compressed or elevated; belly compressed, its edge rounded. Head long and slender; opercular margin very oblique; cheeks triangular, rather broad; teeth evident in both jaws; maxillary not quite reaching gill opening. Gill rakers numerous, longest ⅔ eye. Snout long, ¾ eye, which is 3¾ in head. Dorsal inserted midway between base of median caudal rays and front of eye; anal short; caudal shorter than head; pectorals short, not nearly reaching ventrals. Scales thin, not caducous. Translucent, with a sharply defined silvery stripe as in *S. brownii*, but narrower, confined to one series of scales; many black specks on body and fins. Length 3 inches. Mazatlan to Panama; abundant, replacing *Stolephorus brownii* on the west coast; a slender species, with shorter anal than *S. brownii*. (*ίσχ[α]νός*, slender.)

*Stolephorus ischanus*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1881, 340, Mazatlan. (Type, No. 28246. Coll. Gilbert.)

### 723. STOLEPHORUS BROWNII (Gmelin).

(Striped Anchovy; Manjúa.)

Head 3¾; depth 4¾; eye 3½. D. 15; A. 20; scales 40. Body rather elongate, compressed, not elevated; belly compressed, serrulate. Head rather short, the snout 5 in head, projecting much beyond the tip of the lower jaw. Teeth pretty strong; maxillary extending beyond base of mandible, but not quite reaching to the edge of the gill opening. Eye large; cheeks triangular, scarcely larger than eye. Gill rakers long, ⅔ diameter of eye, but shorter than in *S. compressus*. Anal with a sheath of scales; dorsal inserted nearer caudal than snout. Olivaceous, translucent, sides silvery; the silvery lateral band about as wide as the eye, very distinct. Length 4 to 6 inches. Cape Cod to Brazil; very abundant southward, both on the Florida Coast and in the West Indies; the most abundant of the American species. (Named for Patrick Browne, author of the History of Jamaica, 1756.)

*Piquitinga*, Marcgrave, Hist. Bras., 159, 1648, Brazil.
*Menidia*, Browne, Hist. Jamaica, 441, 1756, Jamaica.
*Atherina brownii*, Gmelin, Syst. Nat., 1397, 1788, Jamaica; after Browne.
*Esox epsetus*, Bonnaterre, Tabl. Ichth., 175, 1788, Jamaica; after Browne.
*Engraulis lemniscatus*, Cuvier, Règne Animal, Ed. 2, ii, 323, 1829, Brazil; after *Piquitinga* of Marcgrave.
*Engraulis tricolor*, Agassiz, Spix, Pisc. Brasil., 51, 1829, Bahia; Pará.
*Engraulis piquitinga*, Agassiz, Spix, Pisc. Brasil., pl. 23, fig. 1, 1829; types of *tricolor*.
*Argentina menidia*, Gronow, Cat., 141, 1854; after Browne.
*Stolephorus hiulcus*, Goode & Bean, Proc. U. S. Nat. Mus., 1879, 343, (depth 5½, anal rays 22), Clearwater Harbor, Florida. (Type, No. 23632. Coll. Dr. Velie.)
*Engraulis brownii*, Günther, Cat., vii, 389, 1868.
*Stolephorus browni* and *hiulcus*, Jordan & Gilbert, Synopsis, 273, 1883.

### 724. STOLEPHORUS CULTRATUS, Gilbert.

Head 3⅔; depth 4⅙. D. 12; A. 20; scales 40. Body compressed, of medium depth, the abdomen compressed to an edge both in front of and behind the ventral fins, but without serrations; behind the ventrals the edge is sharply carinate. Head slender and sharp, the snout long and compressed, extending beyond tip of lower jaw for a distance nearly equaling diameter of orbit; maxillary abruptly widened behind angle of mouth, then tapering to a rather sharp point, which extends beyond mandibular articulation nearly to gill opening. Teeth in lower jaw small, but distinctly visible; in upper jaw larger toward tip of maxillary, where they are directed forward. Opercle narrow, scarcely as wide as exposed portion of preopercle, the margin moderately oblique, not wavy. Front of dorsal midway between base of caudal and front of pupil; base of ventrals midway between origin of anal and articulation of mandible; origin of anal behind last ray of dorsal. Scales closely adherent, rather thick and firm. Olivaceous, the dorsal region with black specking; a silvery band along middle of sides, very narrow anteriorly, but increasing in width to opposite anal fin, where it is as wide as eye; snout and margin of caudal lobes dusky. Length 3⅓ inches. Santa Margarita Island, Lower California. (*cultratus*, knife-formed.)

*Stolephorus cultratus*, Gilbert, Proc. U. S. Nat. Mus., 1891, 544, Santa Margarita Island. (Coll. Gilbert.)

### 725. STOLEPHORUS DELICATISSIMUS (Girard).

Head 4¼; depth 4¾. D. 13; A. 23; scales 40. Head short, nearly as deep as long; eye large, much longer than the blunt snout, which projects considerably beyond the lower jaw. Gill rakers numerous, slender, nearly as long as the eye. Maxillary reaching past the root of the mandible. Lower lobe of caudal the longer; dorsal inserted midway between caudal and front of eye. Very pale olivaceous, translucent, with some dark points, and a silvery lateral band not as wide as the eye. Length 3 inches. San Diego Bay and southward in Lower California; locally very abundant. (*delicatissimus*, most delicate.)

*Engraulis delicatissimus*, Girard, Proc. Ac. Nat. Sci. Phila., 1854, 154, and Pac. R. R. Surv., x, 335, 1858, San Diego; (Coll. A. Cassidy); Günther, Cat., vii, 391, 1868.
*Stolephorus delicatissimus*, Jordan & Gilbert, Synopsis, 274, 1883.

### 726. STOLEPHORUS CHŒROSTOMUS (Goode).

(Hog-mouth Fry.)

Head 4; depth 5½; eye 4⅖. D. 13 or 14; A. 23 or 24; scales 38. Snout projecting much beyond lower jaw, which just passes vertical from front of eye; eye as long as snout. Maxillary tapering, reaching gill opening. Gill rakers 10 + 25, as long as eye. Dorsal inserted before middle of body; anal under middle of body; pectorals reaching front of ventrals; scales large. Brownish, with a lateral silvery band, as broad as eye. Length 2¾ inches. Bermuda Islands; common in Hamilton Harbor. (Goode.) Allied to *Stolephorus surinamensis*, but more slender, the depth much less than length of head. (*χοῖρος*, hog; *στόμα*, mouth.)

*Engraulis chœrostomus*, Goode, Amer. Journ. Sci. Arts, August, 1874, 125, Bermudas.

### 727. STOLEPHORUS ARGYROPHANUS (Cuvier & Valenciennes).

Head 3⅘; depth 6; eye 4. D. 14; A. 19. Body elongate, much slenderer than in *S. brownii*, and not so much compressed; belly slightly compressed, not serrated. Head not so deep as in *S. brownii*, more pointed, the snout rather sharp, which is 5 in head. Eye rather small, not longer than snout. Maxillary teeth well developed; mandibular teeth very slender. Gill rakers very long, as long as snout. Maxillary shorter than in *S. brownii*, not reaching quite to the base of the mandible. Scales very deciduous. Ventrals short, very slightly in front of dorsal; caudal peduncle long and slender; dorsal inserted scarcely nearer caudal than snout. Silvery stripe broad, half wider than the eye, bordered above by a dusky streak. Length 4 inches. Gulf Stream; occasional northward; here described from a specimen from Woods Holl, Mass., the type of *S. eurystole*, which seems to be identical with the type of *Stolephorus argyrophanus*, examined by us in Paris. (*ἄργυρος*, silver; *φαίνω*, to show.)

*Engraulis argyrophanus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XXI, 49, 1848, Equatorial Atlantic.
*Stolephorus eurystole*, SWAIN & MEEK, Proc. Ac. Nat. Sci. Phila., 1884, 34, Woods Holl, Mass.
*Stolephorus perfasciatus*, JORDAN & GILBERT, Synopsis, 273, 1883; not of POEY.

### 728. STOLEPHORUS CURTUS, Jordan & Gilbert.

Head 4⅕; depth 4⅔; eye 2¾ to 3¼. D. 11; A. 22 or 23; scales 35–5. Body compressed and deep, the upper and lower outlines little arched; belly before ventrals sharply compressed, serrulate. Head short and deep, the snout blunt, not produced; maxillary not quite reaching gill opening, ending in a sharp point; each jaw with minute teeth. Opercle shortish; cheeks broadly triangular. Gill rakers about ⅔ eye, which is large. Dorsal inserted midway between middle of pupil and base of caudal; caudal short, the lower lobe longer; pectorals very short, barely reaching ventrals; scales thin, caducous. Translucent, with yellow shades and dark dots; sides with a faint diffuse silvery streak. Length 2½ inches. Mazatlan; abundant in the muddy estuary. (*curtus*, short.)

*Stolephorus curtus*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1881, 343, Mazatlan. (Type, No. 29242. Coll. Gilbert.)

### 729. STOLEPHORUS POEYI (Kner & Steindachner).

Head 4⅓; depth 4⅓; eye 3½ to 4. D. 16; A. 23 or 24; scales 42. Body deep and compressed, the outlines not arched; snout short, bluntish, little projecting; eye moderate; both jaws with small teeth; maxillary moderate, extending little beyond joint of mandible; opercles short. Front of dorsal nearer base of caudal than tip of snout; pectorals rather long, not reaching ventrals; ventrals small. Scales deciduous. Greenish, sides silvery, with no distinct lateral band. Rio Bayano, near Panama. (Kner & Steindachner.) (Named for Felipe Poey, the ichthyologist of Cuba, for nearly a half century professor of zoölogy in the University of Havana.)

*Engraulis poeyi*, KNER & STEINDACHNER, Abh. Bayer, Ak. Wiss., x, 1864, 23, with plate, Rio Bayano; GÜNTHER, Cat., VII, 392, 1868.

### 730. STOLEPHORUS OPERCULARIS, Jordan & Gilbert.

Head 3; depth 3¾ to 4; eye 4; D. (injured in specimen examined); A. 20 to 24; scales 39. Body elliptical, short, and moderately compressed; dorsal outline evenly curved; belly compressed, not trenchant. Head large, compressed, the snout bluntish, projecting beyond lower jaw; maxillary short and slender, not reaching joint of mandible; maxillary with very fine teeth; mandible without teeth. Cheeks triangular, the form lower and broader than usual, its base at eye ⅘ length of other sides. Eye much longer than snout; opercles unusually long, the distance from ridge of preopercle at lower posterior angle of cheek back to gill opening equal to distance from same point forward to middle of eye. Insertion of dorsal midway between base of caudal and middle of eye; anal shortish, with a large scaly sheath; pectorals and ventrals short; scales large, rather adherent. Bluish above, silvery below, not translucent; no lateral silvery band. Length 5 inches. Gulf of California to Panama; not very common. (*opercularis*, pertaining to the opercle, which is very long.)

*Stolephorus opercularis*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1881, 275, Punta San Felipe, Gulf of California. (Type, No. 29366. Coll. Lieut. Nichols.)

### 731. STOLEPHORUS MITCHILLI (Cuvier & Valenciennes).

Head 3⅘; depth 4; eye 3. D. 14; A. 25 or 26; scales 37. Body rather short and deep, strongly compressed, the belly compressed and slightly serrated. Head short, compressed, bluntish; snout very short, not longer than pupil; eye very large; maxillary about reaching edge of opercle; both jaws with teeth; cheeks broadly triangular, almost equilateral, smaller than eye; opercle short, little oblique; gill rakers rather long, ⅔ eye. Dorsal inserted midway between caudal and middle of eye; anal very long; pectorals long, about reaching ventrals. Scales thin, caducous. Translucent whitish, sides silvery, with an ill-defined narrow silvery band scarcely wider than pupil; fins with yellowish; many dark dots on body and fins. Length 2½ inches. Cape Cod to Texas on sandy shores, entering rivers; very abundant. The smallest species of Anchovy found north of the tropics. (Named for Professor Samuel Latham Mitchill, author of a valuable early catalogue of the fishes of New York.)

*Engraulis mitchilli*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XXI, 50, 1848, New York; Carolina; Lake Pontchartrain.

*Engraulis louisiana*, LE SUEUR, MS.? CUVIER & VALENCIENNES, Hist. Nat. Poiss., XXI, 51, 1848, Lake Pontchartrain.

*Engraulis duodecim*, COPE, Trans. Amer. Phil. Soc., 1866, 405, Beasleys Point, New Jersey; (dorsal fin said to be entirely anterior to the long and deeply concave anal, which is not true in *S. mitchilli*; the description otherwise agrees).

*Stolephorus mitchilli*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 248.

### 732. STOLEPHORUS LUCIDUS, Jordan & Gilbert.

("SARDINA.")

Head 3⅘; depth 3¾; eye 3. D. 12; A. 27; scales 36–6; B. 11. Body closely compressed, but not greatly elevated, the back weakly arched; belly carinate before anal, but not serrate. Head short, rather pointed, the margins of opercles forming an even curve; maxillary narrow-pointed, reaching little beyond mandibular joint; teeth evident; snout short, projecting, 2 in eye; cheeks oblique, V-shaped, the length more than ½ head; gill rakers rather few and short, the longest 2 in eye. Front of dorsal midway between base of caudal and front of eye; caudal short, the lower lobe the longer; pectoral about reaching ventrals.

Scales rather adherent. Translucent, with black dots on body and fins; some yellow shades; sides with a rather diffuse silvery band, narrowed behind and expanding on base of caudal. Length 5 inches. Mazatlan; locally abundant. (*lucidus*, bright.)

*Stolephorus lucidus*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1881, 341, Mazatlan. (Type, No. 28121. Coll. Gilbert.)

### 733. STOLEPHORUS CLUPEOIDES (Swainson).

Head 3½ to 3⅗; depth 3½; eye 3½. D. 14; A. 25 to 30; scales 40-8. Snout much projecting, blunt, short, about 2 in eye; maxillary obliquely truncate, ending in a point, just before joint of mandible. Teeth very small, in both jaws; gill rakers very fine, setiform, longer than eye; abdomen trenchant, but without conspicuous spines. Insertion of dorsal a little behind middle of body; insertion of anal before middle of dorsal. Silvery; lateral band broad, not very distinct. Size very large, length about a foot. Coast of Guiana and southward; common, ascending streams. (Steindachner; Günther.) (*Clupea sprattus*, the Sprat; εἶδος, likeness.)

?*Engraulis clupeoides*, SWAINSON, Nat. Hist. Fishes, II, 388, 1839, Pernambuco.

*Stolephorus surinamensis*, BLEEKER, Nederl. Tijdschr. Dierk., 1866, 178, Surinam.

*Engraulis surinamensis*, GÜNTHER, Cat., VII, 393, 1868; A. 25 or 26; STEINDACHNER, Ich. Beitr., VIII, 55, 1875; A. 30.

### 734. STOLEPHORUS PRODUCTUS (Poey).

(HECHUDO; GRUBBER BROAD-HEAD.)

Head 3⅗; depth 3½. D. 13; A. 32; scales 40. Body deep, much compressed; belly compressed, not serrate; maxillary tapering behind, nearly reaching gill opening; snout pointed, much projecting beyond lower jaw; teeth very small, in upper jaw only. Dorsal midway between tip of snout and base of caudal. Scales caducous. Greenish, silvery on sides, without distinct lateral band. Cuba and Jamaica. (Poey; Gunther.) Possibly not distinct from *Stolephorus clupeoides*. (*productus*, lengthened.)

*Engraulis productus*, POEY, Repertorio, 380, 1866, Cuba; Günther, Cat., VII, 388, 1868.

### 735. STOLEPHORUS COMPRESSUS (Girard).

Head 4½; depth 3¾. D. 12; A. 31; scales 40. Body strongly compressed, deeper than in most other species; head short, nearly as deep as long; eye large, anterior, much longer than the blunt snout, which does not project much beyond the lower jaw. Gill rakers numerous, slender, nearly as long as the eye. Maxillary reaching beyond the root of the mandible. Lower lobe of caudal the longer; anal fin very long; dorsal inserted midway between caudal and front of eye; pectoral with a basal sheath. Very pale olivaceous, translucent; a silvery lateral band as broad as the eye. Flesh thin and dry, the bones firmer than in *Engraulis mordax*. Length 6 inches. Point Concepcion to Lower California, abundant about San Diego. (*compressus*, compressed.)

*Engraulis compressus*, GIRARD, Pac. R. R. Surv., X, 336, 1858, San Diego. (Coll. A. Cassidy); GÜNTHER, Cat., VII, 395, 1868.

*Stolephorus compressus*, JORDAN & GILBERT, Synopsis, 274, 1883.

### 736. STOLEPHORUS PANAMENSIS (Steindachner).

Head 4⅖; depth 3⅖ to 3⅘; eye about 3⅛. D 12; A 31 to 36; scales 35. Body strongly compressed, the outlines not strongly arched. Snout short, bluntly conical, not ⅔ length of the large eye. Maxillary pointed behind, reaching gill opening; evident teeth in both jaws; no process on subopercle. Insertion of dorsal a little nearer posterior edge of eye than caudal; caudal longer than head; pectorals long, reaching anal. Pale, a well-marked silvery-gray lateral band. Length 6 inches. Panama; not rare.

*Engraulis panamensis*, STEINDACHNER, Ichth. Beitr., IV, 39, 1875, Panama.

### 737. STOLEPHORUS SPINIFER (Cuvier & Valenciennes).

Head 4; depth 4⅛. D. 15; A. 37 or 38. Abdomen compressed, not serrated; snout pointed, much projecting; each jaw with minute teeth; maxillary tapering, reaching gill opening; subopercle projecting beyond opercle, forming a small triangular prominence. Gill rakers slender, longer than eye, 10 + 16. Insertion of dorsal considerably nearer tip of snout than base of caudal; pectorals reaching ventrals. Coloration uniform, no distinct lateral stripe. Length 6 inches. Coast of Guiana; recorded from Panama by Steindachner. (Günther.) (*spina*, spine; *fero*, I bear; in allusion to the subopercular process.)

*Engraulis spinifer*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XXI, 39, 1848, Cayenne; GÜNTHER, Cat., VII, 384, 1868.

## 219. ENGRAULIS, Cuvier.

### (ANCHOVIES.)

*Engraulis*, CUVIER, Règne Animal, Ed. I, 174, 1817, (*encrasicholus*).
*Encrasicholus*, FLEMING, British Animals, 183, 1828, (*encrasicholus*).

We separate from *Stolephorus* as a distinct genus, the typical species of *Engraulis*, with a few related species, the anchovies of the north and south Temperate zones, the species of *Stolephorus* being confined chiefly to the tropics. The technical basis of this division, the increased number of vertebræ in *Engraulis*, is connected with the geographical distribution of its species. *Engraulis* includes spindle-shaped species, little compressed, the sides rounded, the vertebræ in larger number (about 45*), the flesh rather dark, tender, and somewhat oily, not translucent, the bones soft, the appearance and flesh resembling that of the sardines. (*ἐγγραυλίς*, *engraulis*, the ancient name of *Engraulis encrasicholus*, the common anchovy of Europe.)

*a.* Head very long, the snout projecting; gill rakers very long, much longer than eye; A. 22; no distinct silvery lateral band; jaws with small teeth. MORDAX, 738.

### 738. ENGRAULIS MORDAX, Girard.

### (CALIFORNIA ANCHOVY.)

Head 3½; depth 5½. D. 14; A. 22; scales 40; B. 14. Vertebræ 23 + 22 = 45. Body spindle-shaped, formed much as in a sardine, little compressed, rounded above, slightly carinated below, not serrated; head long, anteriorly compressed, the snout pointed and protruding; head nearly twice as long as deep; eye large, very near the tip of the snout; maxillary extending beyond root of mandible; jaws with small teeth; opercle deeper than long, placed very obliquely. Gill rakers very long, much longer than the eye. Bluish above; sides and below silvery, not translucent; no silvery lateral band. Young more compressed, the sides silvery, but not translucent and without lateral band. Flesh comparatively dark and easily torn, as in a sardine. Length 7 inches. Pacific Coast of America from Vancouver Island to Lower California; extremely abundant, in large schools; one of the largest of our anchovies, and the most valuable as food, ranging farther north than its American allies, as does the related *Engraulis encrasicholus* in Europe. (*mordax*, biting.)

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* 44 or 45 in *E. mordax*; 46 or 47 in *S. encrasicholus*.

*Engraulis mordax*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1854. 138, and in Pac. R. R. Surv., x, 334, 1858, Shoalwater Bay, Washington. (Coll. Dr. J. G. Cooper.)

*Engraulis nanus*, GIRARD, *l. c.*, x, 335, 1858, San Francisco; young. (Coll. Heermann); KNER & STEINDACHNER, Sitz. Ak. Wiss. Wien, 1866, fig. 17.

*Stolephorus ringens*, JORDAN & GILBERT, Synopsis, 272, 1883, and of recent authors generally, but probably not identical with *Engraulis ringens*, JENYNS, Voyage Beagle, 136, 1842, a similar species from Chili and Peru, but with anal rays 19, and the head 4 in length. Neither species occurs on the west coast of Mexico.

### 220. ANCHOVIA, Jordan & Evermann.

*Anchovia*, JORDAN & EVERMANN, new genus, (*macrolepidota*).

The genus is closely allied to *Stolephorus*, differing in the form of the body which is very deep, but not strongly compressed, and in the absence of teeth in both jaws in the adult, although teeth are developed in the young. One species known. (*Anchovia*, Anchovy, a name long applied to *Engraulis encrasicholus*, the Anchovy of Europe.)

#### 739. ANCHOVIA MACROLEPIDOTA (Kner & Steindachner).

(SARDINA BOCONA.)

Head 3½; depth 3. D. 15; A. 28 to 30; scales 35–9. Body very short and deep, both dorsal and ventral outlines strongly arched; head one-fourth longer than deep; snout very short, not longer than pupil; not projecting far beyond lower jaw; jaws toothless in adult; minute teeth present in young; maxillary narrow, rounded behind, extending to angle of preopercle; gill rakers fine, long, and very numerous; subopercle with a slight process, as in *S. spinifer*. Abdomen slightly compressed. Scales adherent. Origin of dorsal slightly behind middle of body; ventrals very small, pectorals rather long. Silvery, sides with an indistinct bluish band. Length 8 inches. Gulf of Mexico to Panama, very abundant about Guaymas where it is often cast up dead on the beach in great numbers; one of the largest species of anchovy. (*μακρολεπιδοτός*, large-scaled.)

*Engraulis macrolepidotus*, KNER & STEINDACHNER, Abhandl. Bayer, Akad. Wiss., x, 1864, 21, pl. III, fig. 2, Rio Bayano, Panama; GÜNTHER, Cat., VII, 385, 1868; STEINDACHNER, Ichth. Beitr., IV, 37, 1875.

*Stolephorus macrolepidotus*, EVERMANN & JENKINS, Proc. U. S. Nat. Mus., XIV, 1891, 134.

## 221. CETENGRAULIS, Günther.

*Cetengraulis*, Günther, Cat. Fishes, Brit. Mus., vii, 383, 1868, (*edentulus*).

This genus differs from *Stoleyhorus* in having the gill membranes broadly united. The gill rakers are usually long, and the teeth are rudimentary or wanting. Two species. (*κῆτος*, whale; *Engraulis*; the long gill rakers suggesting whalebone.)

*a.* Anal rays 20 to 22; eye $5\frac{1}{2}$ in head. MYSTICETUS, 740.
*aa.* Anal rays 23 to 25; eye $4\frac{1}{2}$ in head. EDENTULUS, 741.

### 740. CETENGRAULIS MYSTICETUS (Günther).

Head $2\frac{2}{3}$ to $2\frac{4}{5}$; depth $3\frac{3}{5}$; eye $5\frac{1}{2}$. D. 15 to 17; A. 20 to 22; scales 42–14. No teeth; maxillary not reaching root of mandible; gill rakers very long, setiform, 10 + 42. Insertion of dorsal midway between eye and base of caudal; pectorals extending to or a little beyond ventrals. Coloration uniform. Panama. (Günther.) (*Balæna mysticetus*, the Right Whale, the long gill rakers suggesting whalebone.)

*Engraulis mysticetus*, Günther, Proc. Zoöl. Soc. Lond., 1866, 604, Panama.
*Cetengraulis mysticetus*, Günther, Cat., vii, 383, 1868.

### 741. CETENGRAULIS EDENTULUS (Cuvier).

(Bocon.)

Head $3\frac{1}{4}$ to $3\frac{1}{2}$; depth 3; eye 4 to $4\frac{1}{2}$. D. 15; A. 23 to 25; scales 40–11. Body deep, not greatly compressed; belly compressed, bluntly trenchant, not serrate; snout short, sharply pointed, $1\frac{2}{3}$ in eye; maxillary slender, finely toothed posteriorly only in the young, not reaching root of mandible; lower jaw toothless. Gill rakers close-set, longer than eye, $3\frac{1}{2}$ in head; cheeks triangular, longer than high. Scales not caducous. Insertion of dorsal midway between front of eye and base of caudal; pectoral short, 2 in head, not reaching ventral; caudal deeply forked, $1\frac{1}{2}$ in head; dorsal and anal with large basal sheaths. Silvery, darker above, a dark lateral band concealed by the silvery scales. Length 6 inches. West Indies to Brazil, common in Cuba. (*edentulus*, toothless, which is not quite true of young examples.)

*Sprat*, Sloane, Hist. Jamaica, ii, 282, 1727, Jamaica.
*Engraulis edentulus*, Cuvier, Règne Animal, Ed. 2, ii, 323, 1829, Jamaica; after Sloane; Cuvier & Valenciennes, Hist. Nat. Poiss., xxi, 51, 1848.
*Engraulis brevis*, Poey, Repertorio, i, 379, 1866, Cuba.
*Cetengraulis edentulus*, Günther, Cat., vii, 383, 1868.
*Cetengraulis brevis*, Swain & Meek, Proc. Ac. Nat. Sci. Phila, 1884, 35.

## 222. PTERENGRAULIS, Günther.

*Pterengraulis*, Günther, Cat. Fishes, vii, 398, 1868, (*atherinoides*).

This genus is very close to *Stolephorus*, differing chiefly in the insertion of the dorsal, which is a little behind the front of the very long anal fin. South American. (*πτερόν*, fin; *Engraulis*.)

### 742. PTERENGRAULIS ATHERINOIDES (Linnæus).

Head $4\frac{2}{5}$; depth 4; eye $5\frac{1}{4}$; snout $6\frac{2}{3}$. D. 10 or 11; A. 31 to 33; scales 40 to 44–8. Body elongate, compressed, the lower profile arched like the upper, the ventral edge trenchant, not serrate; snout short, blunt, upturned; teeth small; maxillary not reaching joint of mandible; gill rakers short, 7 + 14, the longest $\frac{4}{7}$ eye. Pectoral scarcely shorter than head, reaching middle of length of ventrals; insertion of dorsal midway between base of caudal and base of pectoral; anal inserted before dorsal; scales deciduous. Silvery lateral band broad, not strongly marked, narrowed on the tail. Coasts of Guiana and Brazil, ascending rivers. (Steindachner.) (*atherinoides*, like *Atherina*, referring to the silvery stripe.)

*Clupea atherinoides*, LINNÆUS, Syst. Nat., Ed. XII, 523, 1766, Surinam.
*Engraulis atherinoides*, GÜNTHER, Cat., VII, 398, 1868; STEINDACHNER, Ichth. Beitr, VIII, 59, 1875.
*Pterengraulis atherinoides*, EIGENMANN & BRAY, Ann. N. Y. Ac. Nat. Sci., 1894, 627.

## 223. LYCENGRAULIS, Günther.

*Lycengraulis*, GÜNTHER, Cat. Fishes, VII, 399, 1868, (*grossidens*).

This genus differs from *Stolephorus* chiefly in the dentition, the teeth being unequal in size, some of them canine-like. The known species are South American. (*λύκος*, wolf; *Engraulis*.)

### 743. LYCENGRAULIS GROSSIDENS (Cuvier).

Head $4\frac{1}{2}$; depth $4\frac{4}{5}$; B. 13; D. 14 or 15; A. 25 to 28; scales 40. Body compressed; snout pointed, projecting; upper teeth strong, subequal, lower still stronger, 14 to 18 on each side, between them a few smaller teeth maxillary tapering, reaching angle of lower jaw; gill rakers very short, lanceolate, about 10 + 12 to 15. Insertion of dorsal midway between middle of eye and base of caudal; anal inserted below posterior half of dorsal. Abdomen compressed, without scutes. Pectorals reaching ventrals. Silvery band broad, not well defined. Coast of Guiana and Brazil, very abundant southward; a good food-fish. (Günther.) (*grossus*, large; *dens*, tooth.)

*Engraulis grossidens* (CUVIER) AGASSIZ, Spix, Pisc. Brasil., 50, 1828, Rio Janeiro.
*Engraulis janeiro*, AGASSIZ, Spix, Pisc. Brasil., pl. 24, fig. 1, 1828, Rio Janeiro.
*Engraulis dentex*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XXI, 28, 1848, Rio Janeiro.
*Lycengraulis grossidens*, EIGENMANN & BRAY, Ann. N. Y. Ac. Nat. Sci., 1894, 626.

## Family LXIII. ALEPOCEPHALIDÆ.

Body oblong, compressed, covered with thin cycloid or keeled scales, or with naked skin; head naked. Lateral line present or absent. No barbels. Mouth moderate or large; margin of the upper jaw formed by the premaxillaries and the maxillaries, the former being placed along the upper anterior edge of the latter. Teeth feeble. Opercular apparatus complete, its bones thin. Phosphorescent spots none, or rudimentary, placed in nodules of the naked skin. No adipose fin; dorsal fin long and low, posterior, inserted nearly opposite the anal; pectorals short, placed rather high; ventrals usually well back, sometimes wanting. Gill openings very wide, the membranes free from the isthmus. Pseudobranchiæ present; no gular plate; no air bladder. Stomach curved, without blind sac; pyloric cœca in moderate number. Fishes of the deep seas; but one species known until recently, when 6 genera and numerous species have been described from the abyssal faunæ of the mid-Atlantic and Pacific. (*Alepocephalidæ*, GÜNTHER, Cat., VII, 477, 1868.)

*a.* Scales well developed, cycloid; teeth small; lateral line present.
  *b.* Ventral fins well developed.
    *c.* Mouth small; maxillary with teeth; body rather deep.
      *d.* Dorsal and anal rather short, of 15 to 17 rays, similar to each other; opercular flaps long; head large. ALEPOCEPHALUS, 224.
      *dd.* Dorsal and anal longer, of 20 to 25 rays each, the anal the longer; opercular flaps moderate. MITCHILLINA, 225.
    *cc.* Mouth rather large, moderate; body more elongate.
      *e.* Anal not longer than dorsal; teeth on palatines; maxillary with teeth.
        *f.* Dorsal longer than anal and inserted far in front of it. BATHYTROCTES, 226.
        *ff.* Dorsal scarcely longer than anal and inserted nearly opposite it. TALISMANIA, 227.
      *ee.* Anal twice as long as dorsal; body rather elongate; jaws strong; no palatine teeth. CONOCARA, 228.
  *bb.* Ventral fins wanting; body short, compressed; maxillary with teeth; scales keeled. PLATYTROCTES, 229.
*aa.* Scales wanting; skin thick, rugose, with nodules; no lateral line; teeth minute; ventral fins present. ALEPOSOMUS, 230.

## 224. ALEPOCEPHALUS, Risso.

*Alepocephalus*, RISSO, Mém. Ac. Nat. Sci. Turin, XXV, 270, 1820, (*rostratus*).

Body oblong, compressed. Mouth rather small, the snout somewhat prolonged; jaws nearly equal in front; a series of small teeth in each jaw and on the vomer and palatines. Eye very large. Gill membranes entirely separate. Branchiostegals 6. Opercular bones thin, the opercle with extended membranous flaps. Dorsal low, not very long, with a scaly base, similar to the anal; pectorals and ventrals moderate; caudal moderately forked. Scales rather large, thin and cycloid; no phosphorescent spots. Color violet black. Deep-sea fishes, found in most parts of the ocean. (*ἀ*, privative, without *έπος*, scale; *κεφαλή*, head.)

*a.* Head one-third of total length or nearly so; scales not minute. D. 15 to 17; A. 17.
  *b.* Scales moderate (in about 67 series). Snout 9 in body; eye 4 in head. PRODUCTUS, 744.
  *bb.* Scales small (in about 90 series). Snout 11 to 12 in body.
    *c.* Eye 3⅓ in head; pectoral 3½ in head, about as long as eye. AGASSIZII, 745.
    *cc.* Eye 4¼ in head; pectoral 2½ in head, much longer than eye. TENEBROSUS, 746.

### 744. ALEPOCEPHALUS PRODUCTUS, Gill.

Head $2\frac{7}{9}$; depth 4; eye 4; snout 3. D. 17; A. 17; scales 9–67–12. Resembling *A. agassizii* in form and proportions, but with larger scales, smaller eye, and longer snout. Body quite robust, its height at the pectoral origin nearly one-fourth length from snout to base of median caudal rays. Least height of the tail about one-half length of body. Posterior margin of orbit nearly equidistant between snout and opercular margin; upper jaw extending a little behind vertical from posterior margin of pupil; lower jaw shorter and included, nearly one-half as long as the head. Interorbital width 7 in head; width behind the orbits less than 3. Insertion of dorsal above vent, length of its base twice diameter of eye; anal base under anterior portion of dorsal, the length of its base about ¾ that of dorsal. The caudal fin has its median rays as long as the diameter of the eye, and the external rays at least ⅕ the total length of the fish. The pectoral commences at a distance from the snout equal to ¼ of the length of the body. The ventrals are inserted considerably behind the middle of the length (0.57), and appear to have been at least as long as the diameter of the orbit. The type was obtained by the *Albatross* from station 2035, at a depth of 1,362 fathoms. (Goode & Bean.) (*productus*, drawn out.)

*Alepocephalus productus*, GILL, Proc. U. S. Nat. Mus., 1883, 256, Gulf Stream at Albatross Station 2035, in 1,362 fathoms; (Type, No. 33341. Coll. *Albatross*); GOODE & BEAN, Oceanic Ichthyology, 37, fig. 46, 1895.

### 745. ALEPOCEPHALUS AGASSIZII, Goode & Bean.

Head 3; depth 5; eye 3½. D. 15; A. 17; scales 10–90–11. Body a little deeper than in *Mitchillina bairdii*. Head compressed, the snout conically elongate, the lower jaw slightly produced; width of head 9½ in length of body (12 in *M. bairdii*). Scales parchment-like. Dorsal inserted directly above vent, the distance from its origin to base of caudal ⅓ its distance from front of eye; anal inserted under second ray of dorsal. Length of pectoral equal to diameter of eye, 10½ in body. Ventral about ⅙ of head. Dusky; head and fins nearly black. Gulf Stream, latitude 30°, in 922 fathoms. (Goode & Bean.) (Named for Professor Alexander Agassiz, in whose deep-sea researches the species was obtained.)

*Alepocephalus agassizii*, GOODE & BEAN, Bull. Mus. Comp. Zoöl., 1882, 215, Gulf Stream; GOODE & BEAN, Oceanic Ichthyology, 37, 1895.

### 746. ALEPOCEPHALUS TENEBROSUS, Gilbert.

Head 3; depth 4⅔ to 5; eye 4¼. D. 17; A. 17; P. 10; scales 16–90–16, 55 tubes in lateral line. Allied to *A. agassizii*. Body compressed, elongate; maxillary reaching front of pupil, its length from snout 2⅕ in head; teeth in single series. Snout short, compressed, 3¾ in head. Dorsal ending slightly before anal; pectoral 2½ in head, much longer than eye. Scales of lateral line much enlarged, forming a raised ridge. Uniform blue-black. Santa Barbara Channel, California, at 359 to 822 fathoms. (Gilbert.) (*tenebrosus*, dusky.)

*Alepocephalus tenebrosus*, GILBERT, Proc. U. S. Nat. Mus., 1891, 546, Santa Barbara Channel. (Coll. Gilbert.)

## 225. MITCHILLINA, Jordan & Evermann.

*Mitchillina*, JORDAN & EVERMANN, new genus, (*bairdii*).

In discussing the species of *Alepocephalus*, Goode and Bean make the following observations:

> There are two distinct groups in *Alepocephalus*, probably of subgeneric value. The first group includes the type, *A. rostratus*, Risso. It is characterized by a somewhat short, compressed body, large head, with extended membranaceous flaps, and by short dorsal and anal fins, similar in size and shape and nearly opposite each other.
>
> *A. bairdii* represents another type, having a stout body, about as high in proportion to its length as in *A. agassizii*, etc., but with a smaller head

and less voluminous opercular flaps. The eye is comparatively much smaller (18 in total length), and is nearer the upper profile of the head. The vertical fins are stronger and more muscular, and are heavily scaled at their bases. Lateral line nearly straight. Maxillaries slender, not expanded posteriorly.

For the second group as above indicated we suggest the name *Mitchillina.* (In honor of the faithful and enthusiastic ichthyologist, Samuel Latham Mitchill, United States Senator from the State of New York, 1804–1809, the first to study systematically the fishes of New York Harbor.)

### 747. MITCHILLINA BAIRDII (Goode & Bean).

Head $4\frac{1}{3}$; depth $5\frac{1}{3}$; eye $4\frac{1}{2}$. D. 22; A. 25; P. 12; V. I, 9; pyloric cœca 15; B. 6; scales 7–65–11. Body rather elongate; head moderately compressed, subconical, the lower jaw included; maxillary extending nearly to below middle of eye; eye large, as long as snout. Dorsal inserted slightly in advance of anal. Uniform indigo-blue, the color extending to the inside of the mouth and the gill membranes. Length 24 inches. Grand Banks; dredged at a depth of 200 fathoms. (Goode & Bean.) (Named for Professor Spencer Fullerton Baird, then at the head of the United States Commission of Fish and Fisheries.)

*Alepocephalus bairdii*, GOODE & BEAN, Proc. U. S. Nat. Mus., 1879, 55, Grand Banks of Newfoundland; (Type, No. 22468. Coll. Christian Johnson); JORDAN & GILBERT, Synopsis, 257, 1883; GOODE & BEAN, Oceanic Ichthyology, 38, 1895.

## 226. BATHYTROCTES, Günther.

*Bathytroctes*, GÜNTHER, Ann. Mag. Nat. Hist., 1878, 249, (*microlepis*).

Body rather elongate, compressed, covered with moderate scales. Mouth wide, extending to below middle of eye, which is large; maxillary with series of minute teeth, like those on premaxillary, mandible, vomer, and palatines; tongue toothless. Dorsal and anal moderate, the dorsal notably longer than anal and inserted considerably in front of the latter. Gill rakers lanceolate. Deep sea. (*βαθύς*, deep; *τρώκτης*, one who gnaws.)

### 748. BATHYTROCTES STOMIAS, Gilbert.

Head $3\frac{3}{7}$; depth $5\frac{2}{5}$; eye small, $6\frac{1}{4}$; snout $3\frac{2}{5}$. D. 17; A. 14; P. 9; scales 9–57–10. Mouth much larger than in other species, the front of eye over middle of upper jaw. Body slender, the depth of caudal peduncle half that of body. Premaxillaries extended forward, making a triangular projection, as in *Labidesthes*; maxillary $1\frac{3}{4}$ in head; teeth uniform, incurved, depressible. Top of head with a deep lengthwise groove from nape to snout, a large mucous canal which borders it posteriorly opening above eye. Gill rakers 5 + 13, long and slender, the longest $\frac{2}{3}$ eye. Dorsal beginning before vent; the anal inserted slightly behind its middle; caudal forked. Dark brownish, the fins, etc., black. Length 13 inches. Coast of Oregon, in 877 fathoms. (*stomias*, large-mouthed.)

*Bathytroctes stomias*, GILBERT, Proc. U. S. Nat. Mus., 1890, 53, Coast of Oregon, in 877 fathoms, *Albatross* station 3074. (Type, No. 43081. Coll. Gilbert.)

## 227. TALISMANIA, Goode & Bean.

*Talismania*, Goode & Bean, Oceanic Ichthyology, 41, 1895, (*homopterus*).

This genus is closely allied to *Bathytroctes*, differing chiefly in the longer vertical fins, the dorsal and anal being similar to each other and nearly opposite. Deep sea. (Named for the *Talisman*, one of the French vessels (*Travailleur et Talisman*) employed in deep-sea explorations.)

| | |
|---|---|
| *a.* Maxillary reaching vertical from anterior margin of orbit. | ANTILLARUM, 749. |
| *aa.* Maxillary reaching vertical from posterior margin of orbit. | ÆQUATORIS, 750. |

### 749. TALISMANIA ANTILLARUM, Goode & Bean.

Head 3½; depth 5; eye 3; pupil large, 2½ in orbit; snout 4. D. 20; A. 22; B. 7; P. 13; V. 8. Scales 47. Maxillary reaching orbit, and essentially to the vertical from the anterior margin of the pupil; bones of head thin; head compressed, moderately deep, its depth at occiput ⅘ its length; profile of head in advance of orbit, slightly concave; upper margin of orbit approaching very close to upper profile; supraorbital rim forming a portion of dorsal profile of the head; width of interorbital space nearly half diameter of eye. Eye large, conspicuous. Infraorbital ring very narrow; maxillary separated from the orbit by a very narrow strip of bone. Snout sharply conical, its upper profile concave, jaws equal in front. Dentition feeble; all the teeth equal, minute, uniserial; intermaxillary and maxillary toothed throughout; vomerine series transverse and straight, slightly interrupted in the middle; palatine series nearly as long as the vomerine; the two last-named series confluent. Branchiostegals 7, exceedingly slender and long. Gills 4, the fourth well developed, with a slit behind it; gill laminæ short, especially on the convex portion of the arches; gill rakers long, laneceolate, closely set, 17 on the outer branchial arch below the angle, 7 above. Vent equidistant between root of caudal and gill opening; origin of the dorsal nearer to the latter; dorsal fin longer than high, its anterior rays increasing in length from eighth to nineteenth ray; origin of the anal somewhat in advance of dorsal, which is inserted over third ray at the point where it emerges from its scaly sheath; caudal fin deeply emarginate; pectoral fin inserted in lower third of height of body, moderately broad at its base; its upper rays nearly twice as long as lower ones; its length half that of head; its tip, when extended straight, in vertical from insertion of ventral, or opposite twelfth scale of lateral line; ventrals close together, not reaching vent, but to origin of the sheath which incloses both vent and base of anal; their length equal to that of lower rays of pectoral, and to length of snout; root of ventral midway between tip of snout and rows above the ventrals. Lateral line in a concave sweep from near upper angle of operculum to a point above the origin of basal sheath of the anal, thence in a straight line to base of caudal. Color of the specimen (denuded of scales and long kept in alcohol) rusty brown; head blackish.

A single specimen was obtained by the *Albatross* at station 2394, latitude 28° 38′ 30″ N., longitude 87° 02′ W., at a depth of 420 fathoms. (Goode & Bean.) (*Antillarum*, of the Antilles.)

*Talismania antillarum*, Goode & Bean, Oceanic Ichthyology, 44, fig. 49, 1895, Gulf of Mexico, in 420 fathoms. (Type, No. 43739.)

### 750. TALISMANIA ÆQUATORIS, Goode & Bean.

Head 2⅓; depth 3⅔; snout 3⅔; eye 4⅔, 1⅓ in snout. D. 22; A. 21; B. 52; V. 7; P. 8; scales 45 to 48. Maxillary reaching vertical from posterior margin of orbit. Bones of head thin; head large, compressed, the depth at the occiput ¾ its length, its width about ⅓; its upper surface longitudinal, concave, and deeply concave between the orbits, with a convexity above the snout; width of interorbital space about equal to diameter of eye; infraorbital ring very narrow; maxillary broad, large, conspicuously dilated at the extremity, its greatest width at this point being more than ⅔ diameter of eye. Cleft of mouth wide; dentition feeble; no traces of teeth upon either vomer or palatine (on typical specimen). Branchiostegals long and slender; gills 4; gill laminæ short, especially on the convex portion of the arches; gill rakers long, strong, broad at the base; 6 + 17 on the outer arch. Vent placed equidistant from root of caudal and root of pectoral; origin of dorsal over vent, slightly in advance of anal; dorsal fin longer than high, its anterior rays increasing in length to the middle of the fin, the longest ray 3⅔ in head, about equal to longest ray of anal; caudal fin deeply emarginate; pectoral inserted far below middle of body; it has a narrow base, and its length in a perfect specimen is probably not greater than diameter of eye. Ventrals close together, remote from the vent, the root being nearly midway between the root of the caudal and the tip of the snout, and equidistant from root of anal and base of pectoral. Scales deciduous, cycloid, the lateral line beginning from a point on a level with the top of the eye, and ascending in a broad curve to a point over the ventrals, thence in a straight line to root of caudal. Color bluish-black. A single specimen, 14½ inches in length, obtained by the *Albatross*, from station 2793, latitude 1° 03′ N., longitude 80° 15′ W., in 741 fathoms. (Goode & Bean.) (*æquatoris*, of the equator.)

*Talismania æquatoris*, GOODE & BEAN, Oceanic Ichthyology, 44, fig. 50, 1895, off coast of Ecuador. (Type, No. 44085.)

### 228. CONOCARA, Goode & Bean.

*Conocara*, GOODE & BEAN, Oceanic Ichthyology, 39, 1895, (*macdonaldi*).

Body elongate, compressed; in the type species strongly suggestive of the Barracuda (*Sphyræna*). Mouth moderate; snout prolonged; jaws strong and powerful, the lower slightly included; teeth in the jaws acicular, rather numerous; also on the vomer, very small; absent from palatines. Eye large. Gill membranes entirely separate. Dorsal moderate in length; anal very elongate, nearly twice as long as the dorsal; pectoral and ventral small; caudal strongly forked. Scales minute and deciduous. Branchiostegals 6, the membrane of the left series folded conspicuously over the origin of that of the right. Opercular bones thin. Gill rakers rather short and stout, moderate in number. Deep sea. (*κῶνος*, cone; *κάρα*, head.)

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|---|---|
| *a.* Body moderately elongate, the depth 5¾ in length. D. 18; A. 36. | MACDONALDI, 751. |
| *aa.* Body very elongate, the depth 8 in length. D. 21; A. 40. | MACROPTERA, 572. |

### 751. CONOCARA MACDONALDI, Goode & Bean.

Head 3⅓ in total length; depth 5¾ to base of caudal; thickness 12; eye 5, 2 in snout; snout 2½. D. 18; A. 36; P. 10; B. 6; V. 6; C. 22; scales 200. Body elongate; snout compressed, and with an obtuse point; the lower jaw included. Mouth large, the upper jaw about ⅓ length of head; the maxillary not reaching to front of eye; mandible reaching to below middle of eye. Teeth on the premaxillary, vomer, and palate very sharp, minute, widely separated, in a single row in each jaw. Nostrils lateral, posterior very much larger, their distance from eye ½ the length of eye. Gill openings wide; opercular apparatus membranous, its elements being very imperfectly ossified. Fifteen gill rakers on the first arch below the angle. Scales very small. Dorsal fin short, about ½ as long as anal fin, its posterior rays inserted nearly over last rays of the latter, distance of its insertion from tip of snout about 5½ times its own length; anal inserted at a distance from the snout equal to 2⅓ times its own length; ventral inserted nearly midway between the snout and the base of the caudal; pectoral short, twice diameter of eye, and inserted below median line of body; caudal fin short, its middle rays not more than ⅔ length of snout, forked. Color uniform deep blue-black in life.

A specimen 8½ inches in length was obtained by the *Blake* at station CLXXII, in 24° 36′ N. latitude, 84° 5′ W. longitude, at a depth of 955 fathoms, and another, 6 inches long, from station CLXV in latitude 24° 36′ N., longitude 84° 05′ W., at a depth of 955 fathoms. Another, 8¼ inches long, was taken by the *Albatross* at station 2392 (latitude 28° 47′ 30″, longitude 87° 27′). (Goode & Bean.) (Named for Hon. Marshall McDonald, Commissioner of Fish and Fisheries.)

*Conocara macdonaldi*, Goode & Bean, Oceanic Ichthyology, 39, fig. 48, 1895, Gulf of Mexico. (Type, No. 39482. Coll. Albatross.)

### 752. CONOCARA MACROPTERA (Vaillant).

Head elongate, 4; depth 8; thickness 11; snout 2½, compressed, with an obtuse point; eye large, 3⅔ in head, 5½ in interorbital width. D. 21; A. 40; P. 8; V. 5; B. 6. Scales more than 100. Mouth moderate, the upper jaw extending considerably beyond the lower, the maxillary scarcely reaching to the anterior margin of the orbit. Teeth on premaxillaries, maxillaries, vomer, and palatines, conical, elongated, rather small, and in a single row in each jaw. Nostrils wide, close together, the anterior near the middle of the length of the snout; gill opening wide; operculum for the most part membranaceous, its elements being very imperfectly ossified; preoperculum curved, thickened on its anterior edge; the interoperculum and suboperculum not prominent, apparently replaced in part by the branchiostegals. Gill rakers about 15 below angle. Vent a little behind the middle of total length. Lateral line extending from the upper part of the branchial opening to middle line of body. Scales remarkably small, those of lateral line very simple.

Dorsal with its outline a little convex, lower behind, and ending at a distance from the caudal equal to the length of its own base, which is equal to about 8 in body; anal more than twice as long, beginning near the vent and terminating a little behind the dorsal, its height nearly the same as that of the dorsal; caudal moderately long, 7 in body, slightly emarginate; pectoral small; ventrals very short. Color reddish brown; head a beautiful azure-blue; fins sepia; iris black; pupil azure-blue. Scales very simple in form; those of the body rounded in outline and measure from 1.5 to 1.6 mm. in diameter. Five pyloric cœca, moderately elongated. No trace of a swim bladder. Sixteen specimens of this species were obtained by the French expedition from the coast of Morocco to Soudan, from the Banc d'Arguin, and from the Canaries, at depths varying from 433 to 1,058 fathoms. A specimen 8 inches in length was obtained by the *Albatross* at station 2751, latitude 16° 57′ N., longitude 63° 12′ W., in 68 fathoms. (*μακρός*, long; *πτερόν*, fin.)

*Alepocephalus macropterus*, VAILLANT, Exp. Sci. Travailleur et Talisman, Poissons, 150, pl. XI, figs. 2*a*, 2*b*, 2*c*, 1888, Coast of Morocco, Soudan, and Canaries.
*Conocara macroptera*, GOODE & BEAN, Oceanic Ichthyology, 39, fig. 43, 1895.

## 229. PLATYTROCTES, Günther.

*Platytroctes*, GÜNTHER, Ann. Mag. Nat. Hist., II, 1878, 249, (*apus*).

Body rather abbreviated, much compressed, and covered with small, keeled scales. Mouth of moderate width; the maxillary, premaxillary and mandible each armed with a single series of small teeth; palate smooth. Eye rather large. Dorsal and anal fins opposite each other on tail, moderately long; adipose fin none; caudal forked; pectorals small; ventrals none. Humeral arch terminating in middle of chest in a long, projecting, acute spine. Gill opening wide; six branchiostegals; gills very narrow; pseudobranchiæ present; gill rakers lanceolate. Pyloric appendages rudimentary. Deep sea. (*πλατύς*, flat; *τρώκτης*, a gnawer.)

### 753. PLATYTROCTES APUS, Günther.

Head 3½; depth 2⅘; eye 3. D. 18; A. 17; P. 20; scales 20. Body much compressed and deep, its greatest depth at about the middle of its length. Head compressed, moderate, logitudinally concave above, the concavity bordered on each side by a perforated muciferous canal, and broadest behind, tapering to a point between the nostrils. Bones of head rather thin, but less so than in *Bathytroctes*. Eye large, equal to snout, and situated close to upper profile. Infraorbital ring incomplete. Mouth rather small, the lower jaw projecting; maxillary broad, short, extending to vertical from margin of orbit. Dentition very feeble; teeth uniserial, uniformly minute, occupying the whole extent of intermaxillary and maxillary, but confined to the front part of mandible; only a few rudimentary teeth are visible on the side of mandible; vomer with a minute tooth on each side; palatines toothless. Branchiostegals extremely slender, curved. Gills 4, the inner one very short; gill laminæ short, especially on the convex portion of the arches; gill rakers long, lanceolate, closely set, 20 + 10 on the outer branchial arch. Vent much nearer root of caudal than to gill opening; dorsal fin commencing immediately above it, the anal behind; these fins are very similar in shape and of moderate height; caudal peduncle more than half as deep as long, its depth being increased by a fold of the integument between the vertical fins; caudal rather short and forked; pectoral very short, only half as long as eye. Scales small, cycloid, each with a longitudinal keel, and not spinigerous, as in *Macrurus*, but simple, as in the keeled scales of a snake; the striations, instead of continually crossing the scale, are interrupted by the raised median line; head entirely scaleless; lateral line straight, running along the middle of the body and tail, and composed of very small pores. Brown; head, pectoral region, the vent, and fringes of the caudal peduncle, black. Length 5½ inches. Mid-Atlantic, Challenger Station 107, in 1,500 fathoms; also in the Arabian Sea. (*ἀ*, without; *πούς*, foot; *απους*, without feet, the ventrals being wanting.)

*Platytroctes apus*, GÜNTHER, Ann. and Mag. Nat. Hist., II, 1878, 249, Mid-Atlantic; (Coll. Challenger); GÜNTHER, Challenger Report, XXII, pl. LVIII, fig. A, 229, 1887; ALCOCK, Ann. and Mag. Nat. Hist., VI, II, 1890, 307; GOODE & BEAN, Oceanic Ichthyology, 46, 1895.

## 230. ALEPOSOMUS, Gill.

*Aleposomus*, GILL, American Naturalist, XVIII, 1884, 433, (*copei*).

Body elongate, scaleless; skin thick, finely rugose, with a considerable number of small nodules upon the belly, and sometimes also upon the sides and the lower part of the head. Lateral line wanting. Mouth moderate, with minute teeth upon the mandible and premaxillary; palatines, tongue, and pharyngeal bones probably toothless. Dorsal and anal fins opposite, similar in form and equal in length; caudal probably forked. Vent behind the middle of the body. Gill openings wide. Deep sea; two species known. (*ἀ*, without; *λέπος*, scale or husk; *σῶμα*, body.)

### 754. ALEPOSOMUS COPEI, Gill.

Head 3⅔; depth 5½; eye 2 in head. Body compressed, its outlines sloping from head to middle of caudal peduncle. Snout short, declivous, its length ½ the horizontal diameter of the eye and about ⅕ that of head. Mandible scarcely extending beyond upper jaw; maxillary extending to vertical from middle of orbit. Small teeth upon mandible and premaxillary. Eye very large, its upper outline not projecting above the dorsal profile, as in *A. socialis* (Vaillant). Gill opening large. Skin thick, slimy; no lateral line distinguishable; no scales present, but numerous tubercles upon the sides of the body; none perceptible on the head. Vent midway between origin of ventral and tip of last dorsal ray. Dorsal origin equidistant from the gill opening and the base of the middle caudal rays; highest in its middle portion, rounding forward and behind; anal inserted immediately under the dorsal, similar in shape and equal in extent; caudal, though mutilated, undoubtedly emarginate, and probably forked. Accessory rays (characteristic not only of *Aleposomus* but of *Xenodermichthys*) not conspicuous; pectoral inserted very low down, close to the posterior angle of the preopercular flap, and appearing to have been feeble, its diameter not much greater than half the diameter of the eye; ventral origin equidistant between posterior margin of eye and base of last dorsal ray. Color uniform blackish.

A single specimen, 3¼ inches in length, was obtained by the *Albatross* at station 2099 in 37° 12′ 20″ N. latitude, 69° 39′ W. longitude, at a depth of 2,949 fathoms. (Named for Prof. Edward Drinker Cope, one of the most able and productive of living workers in ichthyology.)

*Aleposomus copei*, GILL, American Naturalist, XVIII, 1884, 443, Gulf Stream; (Type, No. 33551.) GOODE & BEAN. Oceanic Ichthyology, 47, fig. 51, 1895.

## Family LXIV. SALMONIDÆ.

### (THE SALMON FAMILY.)

Body oblong or elongate, covered with cycloid scales. Head naked. Mouth terminal, large or small, varying much in the different genera; maxillary forming the lateral margin of the upper jaw, provided with a supplemental bone; premaxillaries not protractile. Teeth various, sometimes wanting. Gills 4, a slit behind the fourth. Pseudobranchiæ present. Gill rakers various; gill membranes not connected, free from the isthmus; branchiostegals 10 to 20. No barbels. Dorsal usually nearly median, not greatly elongate, its rays 9 to 15, only one or two of the anterior simple or rudimentary, the others branched; adipose fin present; caudal fin forked; anal fin moderate or rather long; ventrals moderate, nearly median; pectorals placed low. Lateral line present. Abdomen rounded in outline. Parietals not in contact, separated at middle by the intervention of the supraoccipital, which connects with the frontals; epipleural appendages not developed. Air bladder large, stomach siphonal; pyloric cœca very numerous. Ova large, falling into the cavity of the abdomen before exclusion. Genera 10. Species about 70. As now restricted, this is no longer one of the large families of fishes, but in beauty, activity, gaminess, and quality as food, and even in size of individuals, different members of the group stand easily with the first among fishes. The *Salmonidæ* are confined to the northern regions, and north of about 40° N., everywhere abundant where suitable waters occur. Some of the species, especially the larger ones, are marine and anadromous, living and growing in the sea, and entering fresh waters to spawn. Still others live in running brooks, entering lakes or the sea as occasion serves, but not habitually doing so. Others again are lake fishes, approaching the shore, or entering brooks in the spawning season, at other times retiring to waters of considerable depth. Some of them are active, voracious and gamy, while others are comparatively defenseless and will not take the hook. The large size of the eggs and their lack of adhesiveness, with the ease by which the eggs may be impregnated, render the Salmon and Trout especially adapted for artificial culture. The *Salmonidæ* are of comparatively recent evolution, none of them occurring as fossils, unless it be in recent deposits. The instability of the specific forms and the lack of sharply defined specific characters may be in part attributed to their recent origin, as Dr. Gunther has suggested. (*Salmonidæ*, part. Günther, Cat., VI, 1–202, 1866.)

Coregoninæ:

*a.* Mouth not deeply cleft, the maxillary broad, the mandible articulating with the quadrate bone under or before the eye. Dentition more or less feeble or incomplete; scales moderate or large; anal fin rather long; species imperfectly anadromous, or confined to rivers or lakes, their life lasting more than one year.

*b.* Jaws toothless or nearly so; scales large; maxillary short and broad, with a broad supplemental bone.

*c.* Premaxillaries broad, with the cutting edge nearly vertical or directed backward, the lower jaw short and more or less included; cleft of mouth short. Coregonus, 231.

*cc.* Premaxillaries with the cutting edge nearly horizontal and directed forward; lower jaw long, projecting beyond upper; cleft of mouth rather long. Argyrosomus, 232.

*bb.* Jaws, vomer, palatines, and tongue with bands of teeth; maxillary very long; lower jaw prominent; anal fin elongate; scales moderate. Stenodus, 233.

Salmoninæ:

*aa.* Mouth deeply cleft, the long lower jaw articulating with the quadrate bone behind the eyes, the maxillaries rather narrow. Dentition strong and complete; conical teeth on jaws, vomer, and palatines; tongue with two series of strong teeth (sometimes deciduous in very old specimens); scales small.

*d.* Anal fin elongate, of 14 to 17 rays; vomer narrow, long, flat, with weak teeth; species spotted with black, if at all. Oncorhynchus, 234.

*dd.* Anal fin short, of 9 to 12 developed rays.

*e.* Vomer flat, its toothed surface plane; teeth on the shaft of the vomer in alternating rows or in one zigzag row, those on the shaft placed directly on the surface of the bone, not on a free crest; posterior vomerine teeth sometimes deciduous; species black-spotted. Salmo, 235.

*ee.* Vomer boat-shaped, the shaft strongly depressed, without teeth; scales very small, about 200 in the course of the lateral line; species not anadromous; spotted with red or gray.

*f.* Vomer with a raised crest, extending backward from the head of the bone, free from its shaft, this crest armed with strong teeth; hyoid bone with a broad band of strong teeth; species spotted with gray, without bright colors. Cristivomer, 236.

*ff.* Vomer without raised crest, only the head being toothed; hyoid bone with very weak teeth or none; species red-spotted, the lower fins with bright edgings. Salvelinus, 237.

## 231. COREGONUS (Artedi) Linnæus.

(Whitefishes.)

*Coregonus*, Artedi, Genera Piscium, 9, 1738.

*Coregoni*, Linnæus, Syst. Nat., Ed. x, 1758, 310, (*lavaretus*).

*Tripteronotus*, Lacépède, Hist. Nat. Poiss., v, 48, 1803, (*hautin* = *lavaretus*).

*Coregonus*, Lacépède, Hist. Nat. Poiss., v, 263, 1803, (*lavaretus*).

*Coregonus*, Cuvier, Règne Animal, Ed. i, 162, 1817, (*thymallus*, *lavaretus*, etc.; restricted in Ed. 2, to *lavaretus*).

*Prosopium*, Milner, in Jordan, Man. Vert., Ed. 2, 361, 1878, (*quadrilateralis*).

Body oblong or elongate, compressed. Head more or less conic, compressed, the snout more or less projecting beyond the lower jaw. Mouth small, the maxillary short, not extending beyond the orbit, with a well-developed supplemental bone. Teeth extremely minute, if present. Scales moderate, thin, cycloid, rather firm. Dorsal fin moderate; caudal fin deeply forked, anal fin somewhat elongate; ventrals well developed. Pseudobranchiæ large. Gill rakers varying from short and thickish to long and slender. Air bladder very large. Vertebræ 56 to 60. Stomach horseshoe-shaped, with many (about 100) pyloric cœca. Ova small. Species about 15, inhabiting the clear lakes of northern Europe, Asia, and America, in Arctic regions descending to the sea. Most of them spawn in late fall or winter near the shore, at other seasons often frequenting considerable depths. The number of distinct species of *Coregonus* has been overestimated by many writers. The geographical range and range of variation of each one are much wider than has hitherto been generally supposed.* The species are highly valued for food, the flesh being generally pale and of fine flavor. The coloration is very uniform; bluish olivaceous above; the sides and below silvery. (*Coregonus*, a name used by Artedi for the European lavaret, or whitefish, *Coregonus lavaretus*, from *κόρη*, the pupil of the eye; *γωνία*, angle; "quia pupilla anteriore parte in angulum acutum procurrit." Artedi.)

PROSOPIUM (*προσώπιον*, a mask, from the large preorbitals):

*a.* Gill rakers short, thickish, about 12 to 16 in number on the lower limb of the arch; maxillary short, broad, not reaching eye, the supplemental bone mostly narrow and sharply elliptical; mouth small.

- *b.* Mouth comparatively large, the maxillary about 4 in head; gill rakers very short and thick, 10 + 16; body oblong, the back not elevated.
  - *c.* Scales large, 60 to 63 in lateral line; snout blunt and decurved. COULTERII, 755.
  - *cc.* Scales small, 72 to 90 in lateral line.
    - *d.* Supplemental bone of maxillary rather narrow; scales 83 to 90.
      - *e.* Head moderate, blunt anteriorly, 4½ to 5 in body; tip of snout below level of eye; gill rakers short, 9 + 15; lower fins pale. WILLIAMSONI, 756.
      - *ee.* Head very short, blunt, 5⅔ in body; gill rakers short and slender, about 7 + 14; fins all blackish. KENNICOTTI, 757.
    - *dd.* Supplemental bone of maxillary very broad, semicircular; scales 72 to 80. RICHARDSONII, 758.
- *bb.* Mouth small, the maxillary 5 to 5½ in head; gill rakers shorter and thicker, about 7 + 10, about 5 in eye, fewer than in *C. williamsoni.* Body elongate, the back not elevated nor much compressed. QUADRILATERALIS, 759.

COREGONUS:

*aa.* Gill rakers numerous, long and slender, 17 to 20 on the lower limb of the arch; preorbital long and narrow; maxillary rather long, more than ¼ head, the supplemental bone ovate.

- *f.* Tongue toothless or nearly so; back elevated; head very low and short, especially in old examples.
  - *g.* Back elevated, but not greatly compressed; supplemental bone of maxillary nearly twice as long as deep. CLUPEIFORMIS, 760.
  - *gg.* Back elevated and much compressed; supplemental bone of maxillary more than ⅔ as deep as long; gill rakers about 26. NELSONII, 761.
- *ff.* Tongue with 3 series of small teeth; body elongate, compressed; lower jaw slightly included.
  - *h.* Gill rakers short and few, about 10 + 15, the longest about 2 in eye. LABRADORICUS, 762.

## Subgenus PROSOPIUM, Milner.

### 755. COREGONUS COULTERII, Eigenmann & Eigenmann.

Head 4½ to 5; depth 4½ to 5½; eye 4; snout 4½. D. 10 or 11; A. 10 or 11; scales 8–60 to 63–6. Form rather heavy, little elevated; the snout broad,

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*For a useful analytical key to the species of *Coregonus*, see Bean, in Trans. Amer. Fish Cultural Ass'n, 13th annual meeting, 1884, 33.

very blunt and decurved; greatest depth of head equal to its length less the opercle. Mouth low, the snout but little projecting, maxillary reaching eye in larger specimens, further in the smaller ones; supplemental bone a crescent; gill rakers much as in *Coregonus williamsoni*; scales large. Dull silvery. Head waters of the Columbia River. A small species, not exceeding 8 inches in length, closely related to *Coregonus williamsoni*, but with larger scales. (Named for Dr. John Merle Coulter, the well-known botanist.)

*Coregonus coulterii*, EIGENMANN & EIGENMANN, American Naturalist, November, 1892, 961, Kicking Horse River, at Field, British Columbia, one of the head streams of the Columbia River. (Type, No. 44875. Coll. Eigenmann.)

### 756. COREGONUS WILLIAMSONI, Girard.

(ROCKY MOUNTAIN WHITEFISH; "MOUNTAIN HERRING.")

Head 4½ to 5; depth 4 to 5; eye 4⅔. D. 11 to 14; A. 11 to 13; scales 8 to 10–83 to 87–7 to 10. Body oblong, rather deeper than in *Coregonus quadrilateralis*, but little compressed. Head shortish, conic, the profile more abruptly decurved than in the other species. Snout compressed and somewhat pointed at tip, which is entirely below the level of the eye; preorbital broad, ⅔ width of eye. Maxillary short and very broad, reaching just about to the anterior margin of eye; therefore, apparently longer than in related species, owing to the shortness of the snout; supplemental bone narrow; maxillary contained 4 times in the length of the head; mandible 3 times. Pectoral 1⅕ in head; ventral 1⅖; longest dorsal ray 1⅓. Snout in the males produced, pig-like, in the breeding season. Adipose fin very large, extending behind anal. Gill rakers short and thick, shorter than pupil, about 9 + 15. Color bluish above, sides silvery; breeding males with the under parts white; all the fins tipped with black, caudal and adipose fins steel-blue. Scales on sides strongly tuberculate in breeding males. Length about a foot. Clear streams from the Rocky Mountains to the Pacific, the easternmost records being from Chief Mountain Lake at the head of the Saskatchewan in Montana (as type of *Coregonus couesii*); abundant in the Great Basin, and northwestward on both sides of the Cascade Range; found more often in clear brooks and rivers than in lakes. It readily takes the fly and is an excellent food-fish. (Named for Lieut. R. S. Williamson, in charge of one division of the United States Pacific Railroad explorations.)

*Coregonus williamsoni*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 136, Des Chutes River, Oregon; GÜNTHER, Cat., VI, 187, 1866; JORDAN & GILBERT, Synopsis, 297, 1883; B. A. BEAN, in GILBERT & EVERMANN, Bull. U. S. Fish Comm., XIV, 1894, 55, pl. IX, fig. 3.

*Coregonus couesii*, MILNER, Rept. U. S. Fish Comm. for 1872–73 (1874), 88, Chief Mountain Lake, Montana; (Type, No. 14146. Coll. Coues); JORDAN & GILBERT, Synopsis, 297, 1883.

*Prosopium couesii*, MILNER, in JORDAN, Man. Vert., Ed. 2, 362, 1878.

Represented in the Madison and Yellowstone rivers and other tributaries of the Upper Missouri by

### 756a. COREGONUS WILLIAMSONI CISMONTANUS, Jordan.

Slenderer, with lower fins. Head 5 in length; depth 5 to 5¼; pectoral 1½ in head; ventral 1⅘; longest dorsal ray 1½. Scales 90. Otherwise like the typical form. (*cismontanus*, this side of the mountains.)

*Coregonus williamsoni cismontanus*, JORDAN, Bull. U. S. Fish Comm., IX, 1889, 49, pl. 9, figs. 8, 9, Horsethief Creek, a tributary of Madison River, Montana. (Coll. E. R. Lucas.)

### 757. COREGONUS KENNICOTTI, Milner.

(BROAD WHITEFISH; MUKSUN OF THE RUSSIANS.)

Head small, $5\frac{2}{3}$; depth about $4\frac{2}{3}$. D. 11; A. 14; scales 10–87 to 90–10. Eye moderate, shorter than snout, $5\frac{1}{2}$ in head, $1\frac{4}{5}$ in interorbital space. Scales small, adherent, very regularly imbricated. Head very blunt, premaxillaries wide and vertically placed. Mouth inferior, with the high blunt snout but little projecting. Maxillary reaching slightly beyond the vertical from front of eye, its length, measured from its anterior articulation, equal to length of snout, and contained $4\frac{2}{5}$ times in the head ($=4$ in head when measured from tip of snout); maxillary broadly ovate, apparently slenderer than in *C. richardsonii* as figured by Günther, and with different outlines. Preorbital narrow, its greatest width contained 5 times in its length, and $3\frac{1}{3}$ times in diameter of eye; width of supraorbital bone $\frac{2}{5}$ its length. Gill rakers 6 or $7+14$, short and slender, tapering to a slender flexible point, the longest $\frac{3}{4}$ diameter of pupil. Hyoid bone with a round patch of weak, bristle-like teeth; these are very similar to those found in *Stenodus*, and are disposed in longitudinal series. Vertical height of head at nape less than length of head by $\frac{1}{2}$ diameter of eye; distance from tip of snout to nape $\frac{1}{3}$ distance from nape to front of dorsal; front of dorsal nearer snout than base of median caudal rays by length of snout and eye. Adipose fin large, a wide strip at base covered with small, regularly imbricated scales; inserted over last rays of anal, extending but slightly behind last anal ray; ventrals reaching half way to front of anal; height of dorsal equal to length of head without snout. Color must have been very dark in life; fins all blackish, in spirits, with a bluish tinge; traces of what may have been blackish spots and vermiculations are discernible on basal portion of dorsal and anal fins. The above description from a specimen obtained by Miss Elizabeth Taylor in Great Bear Lake. The type of *C. kennicotti* (No. 8971, Fort Good Hope, British America) possesses the following characters: This specimen is a skin 21 inches long. Length of head $3\frac{1}{2}$ inches; tip of snout to end of maxillary $\frac{13}{16}$ inch; diameter of eye (not orbit) $\frac{5}{8}$ inch; length of longest gill raker $\frac{3}{16}$ inch. Maxillary contained $4\frac{4}{13}$ times in head; longest gill raker $3\frac{1}{3}$ times; width of preorbital $2\frac{3}{4}$ times, in eye. Number of gill rakers $7+13$. Scales 10–90–10.

This species seems closely related to *Coregonus richardsonii*, Günther, with which it may prove identical. As Dr. Bean has already noticed, Günther's description includes no account of the gill rakers, which may be long and numerous, as in *C. clupeiformis*, but indicates a fish with a longer snout, and a broader supplementary maxillary bone. (Gilbert.) Mackenzie and Yukon rivers; locally abundant. (Named for Robert Kennicott, discoverer of the species, one of the first American naturalists to visit Alaska.)

? *Salmo lavaretus*, var. *muchsun*, PALLAS, Reise, III, 705, about 1780.

? *Salmo muksun*, P AS, Zoogr. Rosso-Asiat., III, 398, 1811.

*Coregonus kennicotti*, MILNER, in JORDAN & GILBERT, Synopsis, 298, 1883, Fort Good Hope, British America. (Type, No. 8971. Coll. Kennicott); GILBERT, Bull. U. S. Fish Comm., XIV, 1894, 23.

### 758. COREGONUS RICHARDSONII, Günther.

B. 9; D. 13; A. 13; scales 10–72 to 80–12. Very similar in form to *C. clupeiformis*. Snout of moderate length, obliquely truncated, with the upper jaw projecting beyond the lower; eye shorter than the snout; maxillary extending to anterior edge of the eye, its length 4 in head. Supplementary bone of the maxillary short, broad, semicircular. Length of mandible a little less than least depth of tail. Pectoral longer than head, without snout. Arctic North America. (Günther.) A doubtful species, perhaps identical with *Coregonus kennicotti*, or possibly with *Coregonus nelsonii*. (Named for John Richardson, the accomplished author of the Fauna Boreali-Americana.)

*Coregonus richardsonii*, GÜNTHER, Cat., VI, 185, 1866, exact locality unknown

### 759. COREGONUS QUADRILATERALIS, Richardson.

(PILOT-FISH; MENOMINEE WHITEFISH; SHAD-WAITER; ROUND WHITEFISH.)

Head 5; depth 4⅘; eye 5½. D. 11; A. 10; scales 9–80 to 90–8. Body elongate, not elevated nor much compressed, the back rather broad, the form more terete than in any of the other species. Mouth very small and narrow, inferior, the broad maxillary not reaching to opposite the eye, 5½ in head. Head long, the snout compressed and bluntly pointed, its tip not below level of eye; profile not strongly decurved. Preorbital wider than pupil. Mandible originating under middle of eye, 3⅓ in head. Adipose fin small. Gill rakers short and stoutish, about 7 + 10 in number, 4 to 5 in eye, but rather longer than in *C. williamsoni*. Color dark bluish above, silvery below. Length a foot or more. Lakes of New England and the Great Lakes, northwestward to Alaska, as far south as Yukon River; abundant in cold, deep waters. (*quadrilateralis*, four-sided.)

*Coregonus quadrilateralis*, RICHARDSON, Franklin's Journ., 1823, 714, Fort Enterprise, British America; GÜNTHER, Cat., 176, 1866; JORDAN & GILBERT, Synopsis, 298, 1883.
*Coregonus novæ-angeliæ*, PRESCOTT, Amer. Journ. Sci. Arts, XI, 1851, 342, Lake Winnipiseogee, New Hampshire; GÜNTHER, Cat., 186, 1866.

## Subgenus COREGONUS.

### 760. COREGONUS CLUPEIFORMIS (Mitchill).

(COMMON WHITEFISH.)

Head 5; depth 3 to 4; eye large, 4 to 5. D. 11; A. 11; scales 8–74–9. Vertebræ 59. Body oblong, compressed, always more or less elevated, and becoming notably so in the adult. Head comparatively small and short, the snout bluntish, obliquely truncated; tip of snout on level of lower edge of pupil; width of preorbital less than half that of pupil. Maxillary reaching past front of orbit, about 4 in head. Gill rakers moderate, ½ diameter of eye, usually about 10 + 17 to 19. Color olivaceous above; sides white, but not silvery; lower fins sometimes dusky. Length 2 feet or more. Great Lakes and neighboring waters, rarely ascending streams; not in Alaska nor Arctic America; the best known and most highly valued of the American whitefishes. It feeds on minute organisms. This species, like others of wide distribution, is subject to considerable variations, dependent on food, waters, etc. One of these is the so-called Otsego Bass, var. *otsego* (Clinton), a form landlocked in Otsego Lake at the head of the Susquehanna River. (*Clupea*, a shad or herring; *forma*, shape.)

*Salmo clupeiformis*, MITCHILL, Amer. Month. Mag., II, 1818, 321, Sault Ste. Marie.

*Coregonus albus*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., I, 1818, 231, Lake Erie to Arctic Sea; GÜNTHER, Cat., VI, 184, 1866, and of many authors.

*Coregonus otsego*, the "Otsego Lake Bass," DEWITT CLINTON, Med. & Phil. Register, III, 188, about 1814; Otsego Lake; a landlocked form.

*Coregonus sapidissimus*, AGASSIZ, Lake Superior, 344, 1850, Lake Superior.

*Coregonus latior*, AGASSIZ, Lake Superior, 348, 1850, Lake Superior.

*Coregonus clupeiformis*, JORDAN & GILBERT, Synopsis, 299, 1883.

### 761. COREGONUS NELSONII, Bean.

(HUMPBACK WHITEFISH.)

Head 5; depth 4. D. 12; A. 12; scales 10–88–8. Allied to *Coregonus clupeiformis*, but distinguished by its arched and compressed back; snout not very blunt. Maxillary 4 in head, reaching front of eye. Gill rakers moderate, a little more than half eye, about 26 in number; ventrals a little nearer snout than base of caudal. Coloration plain. Alaska, from Bristol Bay northward, common; a bony species of inferior flavor. (Bean.) (Named for Edward W. Nelson, its discoverer, the well-known ornithologist, who collected largely in Alaska.)

*Coregonus nelsonii*, BEAN, Proc. U. S. Nat. Mus., 1884, 48, Nulato, Alaska. (Type, No. 29903. Coll. Nelson.)

### 762. COREGONUS LABRADORICUS, Richardson.

(SAULT WHITEFISH; MUSQUAW RIVER WHITEFISH; WHITING OF LAKE WINNIPISEOGEE.)

Head 5; depth 3⅕ to 4; eye large, 4⅓ to 5; snout 4½ to 5. D. 11 or 12; A. 11 or 12; scales 10–71 to 76–9. Gill rakers short, about 2 to 2½ in eye, 10 + 15 or 16. Body rather elongate, compressed, the back not elevated. Head rather small and slender, compressed. Distance from tip of snout to occiput about 2⅕ in distance from occiput to origin of dorsal fin. Mouth rather small, the lower jaw short, the snout projecting; the maxillary reaching front of pupil; maxillary bone broad, rather short, its supplementary piece ovate. Mandible reaching middle of eye. Tongue with about three series of small teeth. Supraorbital bone narrow. Dorsal fin high in front, the last rays short. Bluish-black above; silvery below; scales with dark punctulations on the edges; fins all dusky, pectorals and ventrals pale at base. Length 21 inches. Winnipeg and Great Lakes region to the lakes of the Adirondacks and White Mountains, and northeastward; generally abundant in cold, clear lakes and large streams; abundant at the Sault Ste. Marie; a species of good flavor, valued as food. A variable species, perhaps containing several recognizable subspecies.

*Coregonus labradoricus*, RICHARDSON, Fauna Bor.-Amer., III, 206, 1836, Musquaw River, Labrador; GÜNTHER, Cat., VI, 176, 1866; JORDAN & GILBERT, Synopsis, 299, 1883.

?? *Coregonus angusticeps*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XXI, 534, 1848, Saskatchewan River; description brief and erroneous.

*Coregonus neohantoniensis*, PRESCOTT, Amer. Journ. Sci. Arts, XI, 1851, 343, Lake Winnipiseogee, New Hampshire.

## 232. ARGYROSOMUS, Agassiz.

(Ciscoes.)

*Argyrosomus*, Agassiz, Lake Superior, 339, 1850, (*clupeiformis* = *artedi*).
*Allosomus*, Jordan, Manual Vertebrates, Ed. 2, 361, 1878, (*tullibee*).

This genus is very close to *Coregonus*, from which it differs in the larger mouth and more produced jaws, the premaxillaries being placed nearly horizontally, and the lower jaw decidedly projecting beyond them. Gill rakers very long and slender, about 30 on lower limb. Vertebræ 55. These characters are associated with the greater voracity and, in general, greater activity of the species of *Argyrosomus*. The species are numerous in the northern parts of Europe, Asia, and North America, and all are valued as food. (ἀργυρός, silver; σῶμα, body.)

Argyrosomus:

*a.* Body elongate, herring-shaped; scales small, uniform, the free edges convex.

*b.* Lower fins pale or merely tipped with dusky; scales punctate with dark points.

*c.* Eye large, not much, if any, shorter than snout in adult, its length 3½ to 4½ in head.

*d.* Head long, 4 in body; body slender, its depth 5 to 6 in length; distance from occiput to snout 2¼ in distance from occiput to dorsal; teeth on tongue; maxillary 3 in head. OSMERIFORMIS, 763.

*dd.* Head long, 4½ in length; distance from occiput to tip of snout nearly half its distance to front of dorsal fin; pectorals short, reaching about half way to ventrals.

*e.* Maxillary 3¼ to 3½ in head; lower jaw projecting; gill rakers long and numerous, about 16 + 30. ARTEDI, 764.

*ee.* Maxillary longer, 2⅗ to 3 in head; gill rakers fewer, about 14 + 25. HOYI, 765.

*ddd.* Head shorter, about 5 in length; distance from occiput to tip of snout about ⅖ distance to front of dorsal fin; pectorals long, reaching more than half way to ventrals; maxillary 3⅓ in head. PUSILLUS, 766.

*cc.* Eye small, shorter than snout, about 5 times in length of head.

*f.* Head short, about 5 in length.

*g.* Body rather slender, the depth equal to length of head; distance from occiput to snout 2½ to 2⅔ in its distance from dorsal; base of dorsal short. LUCIDUS, 767.

*gg.* Body deep, the depth in adult greater than length of head; distance from occiput to snout 2⅓ to 2½ in distance from occiput to dorsal; base of dorsal longer. LAURETTÆ, 768.

*ff.* Head long, 4 to 4½ in length; lower jaw strong.

*h.* Maxillary very long, 2½ in head; lower jaw much projecting; gill rakers about 15 + 28; distance from snout to occiput 2⅕ in distance from occiput to dorsal; mouth larger than in *A. artedi* or in related species. PROGNATHUS, 769.

*bb.* Lower fins all blue-black; body robust; mouth large; gill rakers numerous, 18 + 30; eye large, 4⅕ in head. NIGRIPINNIS, 770.

Allosomus (ἄλλος, different; σῶμα, body):

*aa.* Body short, deep, compressed, the curve of back similar to that of the belly; scales large, larger forward and closely imbricated, the free margin little convex.

*i.* Jaws equal when closed or lower slightly projecting; depth 3 in length; mouth rather small; maxillary 3½ in head; eye 4½ in head; gill rakers about 16 + 31, long and slender, about equal to eye. TULLIBEE, 771.

### Subgenus ARGYROSOMUS.

#### 763. ARGYROSOMUS OSMERIFORMIS (H. M. Smith).

(SMELT OF THE NEW YORK LAKES.)

Head 4; depth 5 to 6; eye 4. D. 9; A. 13; scales 9–83–10. Body elongate, slender, back not elevated. Head rather large, its width equal to half its length. Length of top of head 2¼ in distance from occiput to dorsal; greatest depth considerably less than length of head. Eye large, equal to snout. Gill rakers very long and slender, as long as eye, 20 + 35. Dorsal fin rather high, its height equal to ⅘ depth of body and 1½ times length of base of fin; its origin nearer base of caudal than snout, its free margin nearly vertical, straight; longest anal ray ⅘ length of base of fin; ventral long, equal to height of dorsal, its length equal to ¾ of distance from ventral origin to vent; ventral origin midway between base of caudal and pupil; adipose dorsal long and slender, of same width throughout, its width ⅓ its length. Mouth large, the lower jaw projecting, the snout straight; maxillary contained 3 times in length of head, its posterior edge extending to line drawn vertically through the anterior margin of pupil; mandible ½ the length of head, its angle under the pupil. Teeth present on the tongue. Color above grayish silvery, sides bright silvery; below white; tips of dorsal and caudal dark. Length 10 inches. Lakes of central New York, known from Seneca Lake and Skaneateles Lake. (Smith.) (*Osmerus*, a smelt, *forma*, form; in allusion to the general shape of the fish, which is known as "smelt" in parts of New York.)

*Coregonus hoyi*, BEAN, Proc. U. S. Nat. Mus., 1882, 658, not of GILL; GOODE, Hist. Aquatic Animals, pl. 197 B, 1884; not of text.

*Coregonus osmeriformis*, HUGH M. SMITH, Bull. U. S. Fish Comm., XIV, 1894, pl. 1, 2, Seneca Lake and Skaneateles Lake, New York. (Type, Nos. 32162 and 32165. Coll. Prof. H. L. Smith and J. C. Willetts.)

#### 764. ARGYROSOMUS ARTEDI (Le Sueur).

(CISCO; LAKE HERRING; MICHIGAN HERRING.)

Head 4½; depth 4½; eye 4 to 4½. D. 10; A. 12; scales 8–75 to 90–7, 10 rows under base of dorsal; vertebræ about 60. Body elongate, compressed, not elevated. Head compressed, somewhat pointed, rather long, the distance from occiput to tip of snout usually a little less than half the distance from occiput to dorsal fin. Mouth rather large, the maxillary reaching not quite to the middle of the pupil, 3¼ to 3½ in head; the mandible 2⅓ in head. Preorbital bone long and slender; suborbital broad; supraorbital nearly as long as eye, about four times as long as broad. Gill rakers very long and slender, as in *Clupea*, 15 to 17 + 28 to 34, the longest 1⅗ in eye. Dorsal fin high, its rays rapidly shortened. Bluish black or greenish above; sides silvery, scales with dark specks; fins mostly pale, the lower dusky-tinged. Length 12 inches. Great Lakes and neighboring waters, not in Alaska nor Arctic America; very abundant, usually frequenting shallow waters. An active, voracious fish, valued as food. (Named for Petrus Artedi, the "Father of Ichthyology," the associate of Linnæus, and perhaps the ablest systematic zoölogist of the 18th century.)

*Coregonus artedi*, Le Sueur, Journ. Ac. Nat. Sci. Phila., i, 1818, 231, Lake Erie; Niagara River; Jordan & Gilbert, Synopsis, 301, 1883.

*Coregonus clupeiformis*, Günther, Cat., vi, 198, 1866, and of many authors, but not *Salmo clupeiformis*, of Mitchill.

*Salmo* (*Coregonus*) *harengus*, Richardson, Fauna Bor.-Amer., iii, 210, 1836, Lake Huron.

*Coregonus harengus*, Günther, Cat., vi, 199, 1866.

Represented in numerous small lakes in Indiana and Wisconsin (Tippecanoe, Geneva, Oconomowoc, La Belle, etc.), by the slightly modified

### 764a. ARGYROSOMUS ARTEDI SISCO, Jordan.

(Sisco of Lake Tippecanoe.)

Smaller than the Lake Cisco, but superior as food; living in deep waters, except in December, when it ascends brooks to spawn. (*Sisco* or *Cisco*, a vernacular name, probably Indian.)

*Argyrosomus sisco*, Jordan, Amer. Nat., 1875, 136, Lake Tippecanoe, Warsaw, Indiana. (Coll. Judge J. H. Carpenter.)

### 765. ARGYROSOMUS HOYI, Gill.

(Moon-eye Cisco; Cisco of Lake Michigan; Kieye of Lake Michigan.)

Head 4½; depth 4½; eye 4⅕ to 4⅔; snout 3⅖ to 3⅚; maxillary 2⅗ to 3 in head, reaching to vertical of middle of pupil. D. 10; A. 11 or 12; scales 8 or 9–73 to 80–7. Gill rakers 14 + 25 or 26, slender, about 2 in eye. Vertebræ 56; branchiostegals 8 or 9. Body rather elongate, compressed, the back somewhat elevated. Mouth rather large, subterminal, the lower jaw shorter than upper, even when the mouth is open; tip of muzzle rather bluntly truncate, somewhat as in a true *Coregonus*; mandible nearly reaching posterior edge of eye, 2⅙ in head. Head rather long, slender, and pointed. Supraorbital and preorbital long and narrow. Distance from tip of snout to occiput 2⅕ to 2⅖ in distance from occiput to origin of dorsal fin. Fins low; free margin of dorsal very oblique, the length of the anterior rays 1⅗ in head, that of the last ray less than half length of the first; longest anal ray 2⅗ in head and more than twice as long as the last ray. Pseudobranchiæ very large; tongue with traces of teeth. Color light iridescent blue on back, scales with a few fine dark punctulations reaching about two scales below lateral line; sides and under parts rich silvery, brighter than in any other of our *Coregoninæ*, much as in *Hiodon* and *Albula*; top of head light olivaceous; cheeks silvery; dorsal, caudal, and pectorals with some dark on their margins; anal and ventrals white, with some dark dustings; the male perhaps a little richer, more iridescent blue on back, and with the scales a little thicker and less closely imbricated. Length 13 inches. Deep waters of Lake Michigan; one of the smallest and handsomest of *Coregoninæ*. The only specimens known were the two sent to Dr. Gill and the one to Dr. Jordan by Dr. Hoy, until recently rediscovered by the United States Fish Commission, who find it to be the principal fish caught in the gill nets in the western part of Lake Michigan. It is taken in large numbers off

Kenosha in 90 fathoms in November during its spawning season. It is a true *Argyrosomus*, though approaching *Coregonus*. (Named for Dr. Philo R. Hoy, of Racine, Wisconsin, an able naturalist, who early collected the fishes of Lake Michigan.)

*Argyrosomus hoyi*, Gill MS., Jordan, American Naturalist, March, 1875, 135, Lake Michigan, near Racine, Wisconsin. (Type, No. 8902. Coll. Hoy.)

*Coregonus hoyi*, Jordan, Man. Vert., Ed. 2, 275, 1878; Jordan & Gilbert, Synopsis, 299, 1883; Smith, Bull. U. S. Fish Comm., xiv, 1894, pl. 1, fig. 1, 6; not *Argyrosomus hoyi*, Milner, Rept. U. S. Fish Comm., 1872–73 (1875), 86 (which is *A. prognathus*), nor *Coregonus hoyi*, Bean, Proc. U. S. Nat. Mus., 1882, 658 (which is *A. osmeriformis*).

### 766. ARGYROSOMUS PUSILLUS (Bean).

Head 5; depth 5; eye 3¾ in head. D. 10; A. 12; V. 11; scales 10–91–9. Body rather elongate, compressed. Form of mouth as in *A. artedi*, the lower jaw considerably projecting; maxillary broad, with rather broad supplemental bone, three times as long as wide, extending not quite to middle of the very large eye, its length 3⅓ in head; preorbital extremely narrow. Mandible 2⅓ in head. Teeth none, or reduced to minute asperities on the tongue. Gill rakers numerous, very long and slender, 49 in all. Dorsal very high, much higher than long, its last rays rapidly shortened, the first rays twice the length of base of fin; insertion of dorsal midway between snout and middle of adipose fin; caudal large, well forked; anal small; ventral inserted under middle of dorsal, very long, ⅚ length of head; pectoral the same length. Scales as in *A. artedi*. Steel-bluish above, with many dark points; belly white; dorsal and caudal mostly blackish; pectorals and ventrals tipped with black; eye blackish, the iris silvery. Length a foot or less. Yukon River to Bering Sea and northward, ascending rivers. (*pusillus*, feeble.)

*Coregonus merckii*, var., Bean, Proc. U. S. Nat. Mus., 1881, 256; Jordan & Gilbert, Synopsis, 300, 1883; not of Günther.

*Coregonus pusillus*, Bean, Proc. U. S. Nat. Mus., 1888, 526, Kowak River, Alaska. (Type, No. 38366. Coll. Chas. H. Townsend.)

### 767. ARGYROSOMUS LUCIDUS (Richardson).

(Great Bear Lake Herring.)

Head small, 5 to 5⅓; depth 4⅓ to 4⅗; eye 5. D. 11 or 12 developed rays; A. 11 or 12. Scales 85 to 87, 11 or 12 scales in an oblique series downward and forward from front of dorsal to lateral line. Eye slightly less than length of snout, 1½ times in interorbital width. Body slender, elongate, the curve of back and belly about equal, the greatest depth exceeding length of head. The snout narrow, almost vertically truncate when mouth is closed, the lower jaw fitting within the upper, but the mouth not inferior. Distance from snout to nape 2⅗ to 3 in distance between nape and front of dorsal. The head is much smaller in one of our specimens than in the other. Mouth oblique, with rather slender maxillary, which extends to vertical midway between front and middle of pupil, its length from tip to articulation equaling distance from end of snout to front of pupil, and contained 3⅔ to 3⅘ in length of head. Supplemental maxillary bone probably broader than in *A. artedi*, from ⅗ to ⅔ greatest width of maxillary. Suborbitals very narrow, their least width less than half diameter of pupil. Supraorbital bone large, its width 2½ to 2⅔ in its length. Gill rakers very long and slender, the longest slightly more than ⅔ length of eye, 16 + 28 in number in each specimen. Front of dorsal slightly nearer tip of snout than base of upper rudimentary dorsal rays. The fins are mutilated, so that their length can not be given. *Adipose fin large, inserted vertically above last anal rays, its height from tip to posterior end of base equaling vertical diameter of eye. Color silvery. As pointed out by Dr. Günther, this northern form differs from *A. artedi* in its shorter head and smaller eye. It seems also to have the premaxillaries placed at a greater angle than in *A. artedi*. Mackenzie River and tributaries. Here described from two specimens from Great Bear Lake River, each 16 inches long, collected by Miss Elizabeth Taylor. (*lucidus*, shining.)

*Salmo* (*Coregonus*) *lucidus*, Richardson, Fauna Bor.-Amer., III, 207, 1836, with good figure, Great Bear Lake.

*Coregonus lucidus*, Günther, Cat., VI, 198, 1866; Gilbert, Bull. U. S. Fish Comm., XIV, 1894, 24.

### 768. ARGYROSOMUS LAURETTÆ (Bean).

Head 5; depth 4; eye 4½ to 5. D. 12; A. 11; V. 12; scales 10–84 to 95–10, 84 to 87 in specimens examined. Body robust, the back elevated; head small and slender, the small eye not longer than snout. Distance from nape to front of snout 2½ times in its distance from dorsal. Maxillary about reaching middle of eye, 3½ in head, its supplemental bone half its length; lower jaw very slightly longer than upper; mandible 2⅓ in head; lingual teeth present. Gill rakers long and numerous, 10 + 25; ventral scale not half length of fin; pectorals short, not reaching half way to ventrals. Scales smaller than in *A. artedi*, 16 cross series under base of dorsal. Alaska, from Yukon River northward to Point Barrow; generally common. Apparently very close to *Argyrosomus lucidus*, but the base of the dorsal longer. (Named for Mrs. Lauretta H. Bean.)

*Coregonus laurettæ*, Bean, Proc. U. S. Nat. Mus., 1881, 156, Point Barrow; Jordan & Gilbert Synopsis, 890, 1883. (Type, Nos. 27695 and 27915. Coll. Capt. C. L. Hooper.)

### 769. ARGYROSOMUS PROGNATHUS (H. M. Smith).

(LONG JAW; BLOATER.)

Head 4⅓; depth 3½ to 4; eye 5. D. 9 or 10; A. 10 to 12. Eye rather small, 1⅓ in snout, 1⅓ in interorbital space, 1⅓ in suborbital space. Scales 9–75–8. Body oblong, much compressed, back elevated, tapering rather sharply towards the narrow caudal peduncle, the adult fish having a slight nuchal hump as in *C. clupeiformis*. Mouth large and strong; snout straight, its tip on level with lower edge of pupil. Top of head 2⅕ in distance from occiput to front of dorsal. Maxillary reaching to opposite pupil, 2½ in head, the length 3½ times its greatest width; mandible projecting beyond upper jaw when mouth is closed, very long, reaching to or beyond posterior edge of eye, 1¾ to 1⅞ in head. Head of medium size, rather short and deep, pointed, cranial ridges prominent. Dorsal rather high, the longest ray ⅓ longer than base of fin, contained 1⅔ times in greatest body depth, and 1½ times in head; free margin slightly concave; origin nearer end of snout than base of caudal. Longest anal ray equal to base of fin and ⅔ height of dorsal. Vertebræ 55. Gill rakers slender, about 15 + 28, about length of eye. Adipose fin the length of eye, its width half its length. Narrowest part of caudal peduncle contained nearly four times in greatest body depth. Ventral as long as dorsal is high, its origin midway between end of snout and fork of tail; pectoral as long as ventral. Lateral line straight except at origin, where it presents a rather marked curve. Sides of body uniformly bright silvery, with pronounced bluish reflection in life; the back dusky, the under parts pure white without silvery color; above lateral line, the upper and lower edges of scales are finely punctulated, central part unmarked, producing light longitudinal stripes extending whole length of body; fins flesh color or pinkish in life, the dorsal and caudal usually showing dusky edges; postorbital area with a bright golden reflection. Iris golden, pupil black. Length 15 inches. Lake Ontario, Lake Michigan, Lake Superior, and doubtless the entire Great Lake Basin, in deep water. (Smith.) This species and *A. osmeriformis* have been confounded under the name *Coregonus hoyi*, though neither much resembles the original of that name. (*πρό*, forward; *γνάθος*, jaw.)

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* The vertical from last ray of anal traverses the posterior third of base of adipose dorsal. This is the only respect in which our specimens fail to agree with Richardson's description. The latter states that the adipose fin is located "about its own breadth posterior to the anal," but this can probably be accounted for by the nature of the specimen, Richardson's description being taken from a stuffed skin.—*Gilbert.*

*Argyrosomus hoyi*, MILNER, Rept. U. S. Fish Comm., II, 1872–73 (1874), 86, Outer Island, Lake Superior; (Coll. Milner); not of GILL.

*Coregonus prognathus*, HUGH M. SMITH, Bull. U. S. Fish Comm., XIV, 1894, 4, pl. 1, fig. 3, Lake Ontario, at Wilson, New York. (Type, No. 45568. Coll. John S. Wilson.)

### 770. ARGYROSOMUS NIGRIPINNIS, Gill.

(BLUEFIN; BLACKFIN.)

Head 4; depth 4; eye 4⅕. D. 12; A. 12; scales 9 or 10–73 to 77–7 or 8. Vertebræ 57. Gill rakers about 18 + 30, rather long and slender, 1½ in eye or 2 in maxillary. Lower jaw slightly projecting; the maxillary ⅕ greater than eye and reaching vertical of front of pupil. Body stout, fusiform, compressed. Head large, stout; mouth large. Distance from tip of snout to occiput about 3⅓ in distance from snout to origin of dorsal fin. Back not arched, profile from occiput to origin of dorsal very gently curved. Eye rather large, longer than snout. Teeth very minute, but appreciable on premaxillaries and tongue. Color dark bluish above; sides silvery, with dark punctulations; fins all blue-black. Length 18 inches. Deep waters of Lake Michigan and small lakes of Wisconsin and Minnesota (Madison, Wisconsin, and Lake Miltona, Minnesota); locally abundant. Larger than most of the other Ciscoes, and with larger mouth than any except *A. prognathus*; known at once by the black fins. (*niger*, black; *pinna*, fin.)

*Argyrosomus nigripinnis*, GILL MS. in MILNER, Report U. S. Fish Comm. for 1872–73 (1874), 87, Lake Michigan, off Racine, Wisconsin. (Coll. Dr. Hoy.)

*Coregonus nigripinnis*, JORDAN, Man. Vert., Ed. 2, 275, 1878; JORDAN & GILBERT, Synopsis, 301, 1883.

### Subgenus ALLOSOMUS, Jordan.

### 771. ARGYROSOMUS TULLIBEE (Richardson).

(Tullibee; "Mongrel Whitefish.")

Head 4 to 4½; depth 3 to 3⅕; eye 4½. D. 11 or 12; A. 11; scales 8 or 9–67 to 74–8. Gill rakers about 16 + 31, long and slender, the longest about equal to eye. Body short, deep, compressed, shad-like, the dorsal and ventral curves similar. Distance from tip of snout to occiput 2 in distance from occiput to origin of dorsal. Caudal peduncle short and deep. Head conic, compressed, much as in *A. nigripinnis*. Mouth large, lower jaw projecting, the maxillary as long as the eye, about 3½ in head, extending past the front of eye, its supplemental bone narrowly ovate, with prolonged point; jaws equal when closed. Eye large, as long as snout. Preorbital narrow; supraorbital elongate, rectangular. Scales anteriorly considerably enlarged, their diameter half larger than the diameter of those on the caudal peduncle, the free margins less convex than in other species. Color bluish above; sides white, punctate with fine dots; each scale with a silvery area, these forming a series of distinct longitudinal stripes. Length 18 inches. Great Lakes, Lake of the Woods, and northward. A handsome and well-marked species. (Tullibee, a name of Indian origin, used by the fur traders.)

*Salmo (Coregonus) tullibee*, Richardson, Fauna Bor.-Amer., iii, 201, 1836, Cumberland House, Pine Island Lake.

*Coregonus tullibee*, Günther, Cat., vi, 199, 1866; Jordan & Gilbert, Synopsis, 301, 1883.

Represented in small lakes of southern Michigan by

### 771a. ARGYROSOMUS TULLIBEE BISSELLI, Bollman.

Maxillary reaching middle of eye; lower jaw projecting. Eye 4⅗ in head; scales 80 to 82, anteriorly scarcely larger than posteriorly. Head 4⅖; depth 3½. Rawson Lake and Howard Lake, Michigan. (Named for John H. Bissell, then president of the Michigan Fish Commission.)

*Coregonus tullibee bisselli*, Bollman, Bull. U. S. Fish Comm., viii, 1888, 223, Rawson Lake and Howard Lake, Michigan. (Type, No. 40619. Coll. Bollman.)

## 233. STENODUS, Richardson.

(Inconnu.)

*Stenodus*,* Richardson, in Back's Narrative Arctic Land Expedition, Back Appendix, 521, 1836, (*mackenzii*).

*Luciotrutta*, Günther, Cat., vi, 164, 1866, (*mackenzii*).

Body rather elongate, little compressed. Head long, the cleft of the mouth wide. Maxillary long, broad, lanceolate, extending far backward, lower jaw projecting much beyond the upper. Dentition very feeble, the teeth extremely small; maxillary toothless; vomer, palatines, and tongue with narrow bands of minute villiform teeth. Gill rakers rigid, awl-shaped, rough interiorly. Branchiostegals 10. Pyloric cœca in great number. Dorsal fin moderate, over ventrals; anal rather long; caudal forked. Scales moderate. Coloration silvery. Migratory fishes of large size, inhabiting the streams of Arctic America and Asia; intermediate between the Whitefish and the Trout. (*στενός*, narrow; *ὀδούς*, tooth.)

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* "This fish, though agreeing with the trout in the structure of the jaws, differs from all the subgenera established by Cuvier in the Règne Animal, in having the teeth disposed in velvet-like bands, and broader on the vomer and palatine bones. From the crowded, minute teeth, the name of *Stenodus* may be given to the subgenus of which the inconnu or *Salmo mackenzii* is the only ascertained species."—*Richardson.*

### 772. STENODUS MACKENZII (Richardson).

(INCONNU.)

Head $4\frac{5}{6}$; eye 6. D. 12; A. 14; scales 100. Eye less than snout, nearly equaling the narrow interorbital width. Maxillary reaching a vertical behind pupil, its length very slightly more than $\frac{1}{3}$ head. Supplemental bone long and narrow, nearly as wide as the maxillary, the anterior end notched, the angle above the notch sharply pointed, the lower angle bluntly rounded. Teeth all weak and flexible, bristle-like; present in a narrow band in upper jaw, the band extending laterally onto proximal fifth of maxillary; a similar narrow band anteriorly in lower jaw; very broad patches of similar, but slightly stiffer, teeth are present on tongue, vomer, and palatines. Gill rakers 7 + 17, the one in the angle reckoned with the vertical limb, very stiff and bony, the longest $\frac{4}{5}$ diameter of eye; they bear in their margins two rows of very short, weak teeth, which do not make them appreciably rough.

Here described from a specimen 32 inches long, from the delta of the Mackenzie River, collected by Miss Elizabeth Taylor. Mackenzie River and its tributaries below the cascades; locally abundant and reaching a large size, usually 5 to 15 pounds, but sometimes 30 to 40 pounds. A fair food-fish, but the flesh is oily.* (Named for its discoverer. Alexander Mackenzie, for whom the river was also named.)

*Salmo mackenzii*, RICHARDSON, Franklin's Journ., 1823, 707, Mackenzie River.
*Luciotrutta mackenzii*, GÜNTHER, Cat., VI, 164, 1866.
*Stenodus mackenzii*, JORDAN & GILBERT, Synopsis, 304, 1883.

## 234. ONCORHYNCHUS, Suckley.

(QUINNAT SALMON.)

*Oncorhynchus*, SUCKLEY, Ann. Lyc. Nat. Hist. N. Y., 1861, 312, (*scouleri*).
*Hypsifario*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 330, (*kennerlyi*).

Body elongate, subfusiform, or compressed. Mouth wide, the maxillary long, lanceolate, usually extending beyond the eye; jaws with moderate teeth, which become in the adult male enormously enlarged in front. Vomer long and narrow, flat, with a series of teeth both on the head and the shaft, the latter series comparatively short and weak; palatines with a series of teeth; tongue with a marginal series on each side; teeth on vomer and tongue often lost with age; no teeth on the hyoid bone. Branchiostegals more or less increased in number. Scales moderate or small. Dorsal fin moderate; anal fin comparatively elongate,

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*According to Dr. Bean our species may be not distinct from the Siberian species, *Stenodus leucichthys* (Guldenstadt).

of 14 to 20 rays. Pyloric appendages in increased number. Gill rakers rather numerous. Ova large. Sexual peculiarities very strongly developed; the snout in the adult males in summer and fall greatly distorted; the premaxillaries prolonged, hooking over the lower jaw, which in turn is greatly elongate and somewhat hooked at tip; the teeth on these bones also greatly enlarged. The body becomes deep and compressed; a fleshy hump is developed before the dorsal fin, and the scales of the back become embedded in the flesh; the flesh, which is red and rich in spring, becomes dry and poor. Salmon, mostly of large size, ascending the rivers tributary to the North Pacific in North America and Asia, spawning in the fall. Only five species are known. The genus is very close to *Salmo*, differing only in the increased number of certain organs. (ὄγκος, hook; ῥύγχος, snout.)

Concerning the habits and distribution of the salmon we quote the following, based on the observations of Jordan & Gilbert, which has been published elsewhere. (See "The Salmon Family," in Jordan's Science Sketches, 35–82, 1887, A. C. McClurg & Co., Chicago.) Some recent observations of Dr. Gilbert and Dr. Evermann are also included:

Of the species of *Oncorhynchus*, the Blueback (*O. nerka*) predominates in Fraser River and in the Yukon River, the Silver Salmon (*O. kisutch*) in Puget Sound, the Quinnat (*O. tschawytscha*) in the Columbia and the Sacramento, and the Silver Salmon in most of the streams along the coast. All the species have been seen by us in the Columbia and in Fraser River; all but the Blueback in the Sacramento and in waters tributary to Puget Sound. Only the King Salmon has been noticed south of San Francisco. Its range has been traced as far as Ventura River. Of these species, the King Salmon and Blueback Salmon habitually "run" in the spring, the others in the fall. The usual order of running in the rivers is as follows: *nerka*, *tschawytscha*, *kisutch*, *gorbuscha*, *keta*. According to early authors, the *tschawytscha* precedes *nerka* in Kamchatka.

The economic value of the spring-running salmon is far greater than that of the other species, because they can be captured in numbers when at their best, while the others are usually taken only after deterioration. To this fact the worthlessness of *Oncorhynchus keta*, as compared with the other species, is probably chiefly due.

The habits of the salmon in the ocean are not easily studied. King Salmon and Silver Salmon of all sizes are taken with the seine at almost any season in Puget Sound. This would indicate that these species do not go far from the shore. The King Salmon takes the hook freely in Monterey Bay, both near the shore and at a distance of 6 to 8 miles out. We have reason to believe that these two species do not necessarily seek great depths, but probably remain not very far from the mouth of the rivers in which they were spawned. The Blueback and the Dog Salmon probably seek deeper water, as the former is seldom taken with the seine in the ocean, and the latter is known to enter the Strait of Fuca at the spawning season, therefore coming in from the open sea. The run of the King Salmon and the Blueback begins generally at the last of March; it lasts, with various modifications and interruptions, until the actual spawning season, September to November, the time of running and the proportionate amount in each of the subordinate runs varying with each different river. By the last of July only straggling Bluebacks can be found in the lower course of any stream; but both in the Columbia and in the Sacramento the Quinnat runs in considerable numbers, at least till October. In the Sacramento the run is greatest in the fall, and more run in the summer than in spring. The spring salmon ascends only those rivers which are fed by the melting snows from the mountains, and which have sufficient volume to send their waters well out to sea. Those salmon which run in the spring are chiefly adults (supposed to be at least three years old). Their milt and spawn are no more developed than at the same time in others of the same species which are not to enter the rivers until fall. It would appear that the contact with cold fresh water, when in the ocean, in some way causes them to run toward it, and to run before there is any special influence to that end exerted by the development of the organs of generation. High water on any of these rivers in the spring is always followed by an increased run of salmon. The salmon canners think, and this is probably true, that salmon which would not have run till later are brought up by the contact with the cold water. The cause of this effect of cold fresh water is not understood. We may call it an instinct of the salmon, which is another way of expressing our ignorance. In general, it seems to be true that in those rivers and during those years when the spring run is greatest, the fall run is least to be depended upon.

It varies for each of the different rivers, and for different parts of the same river. It doubtless extends from July to December. The manner of spawning is probably similar for all the species, but we have no data for any except the Quinnat and the Redfish. In these species the fishes pair off; the male, with tail and snout, excavates a broad, shallow "nest" in the gravelly bed of the stream, in rapid water, at a depth of 1 to 4 feet; the female deposits her eggs in it, and after the exclusion of the milt, they cover them with stones and gravel. They then float down the stream tail foremost. As already stated, a great majority of them die. In the head waters of the large streams, unquestionably all die; in the small streams, and near the sea, an unknown percentage probably survive. The young hatch in about sixty days.

The salmon of all kinds, in the spring, are silvery, spotted or not, according to the species, and with the mouth about equally symmetrical in both sexes. As the spawning season approaches the female loses her silvery color, becomes more slimy, the scales on the back partly sink into the skin, and the flesh changes from salmon-red and becomes variously paler from the loss of oil, the degree of paleness varying much with individuals and with inhabitants of different rivers. In the Sacramento the flesh of the Quinnat, in either spring or fall, is rarely pale. In the Columbia a few with pale flesh are sometimes taken in spring, and a good many in the fall. In Fraser River the fall run of the Quinnat is nearly worthless for canning purposes, because so many are "white-meated." In the spring very few are "white-meated," but the number increases toward fall, when there is every variation, some having red streaks running through them, others being red toward the head and pale toward the tail. The red and pale ones can not be distinguished externally, and the color is dependent upon neither age nor sex. There is said to be no difference in the taste, but there is no market for canned salmon not of the conventional orange color.

As the season advances, the difference between the males and females becomes more and more marked, and keeps pace with the development of the milt, as is shown by dissection. The males have (1) the premaxillaries and the tip of the lower jaw more and more prolonged, both of the jaws becoming, finally, strongly and often extravagantly hooked, so that either they shut by the side of each other like shears, or else the mouth can not be closed. (2) The front teeth become very long and canine-like, their growth proceeding very rapidly, until they are often half an inch long. (3) The teeth on the vomer and tongue often disappear. (4) The body grows more compressed and deeper at the shoulders, so that a very distinct hump is formed; this is more developed in *Oncorhynchus gorbuscha*, but is found in all. (5) The scales disappear, especially on the back, by the growth of spongy skin. (6) The color changes from silvery to various shades of black and red, or blotchy, according to the species. The Blueback turns rosy or brick-red, the Dog Salmon a dull blotchy red, and the Quinnat generally blackish. The distorted males are commonly considered worthless, rejected by the canners and salmon salters, but preserved by the Indians. These changes are due solely to influences connected with the growth of the reproductive organs. They are not in any way due to the action of fresh water. They take place at about the same time in the adult males of all species, whether in the ocean or in the rivers. At the time of the spring runs all are symmetrical. In the fall all males, of whatever species, are more or less distorted. Among the Dog Salmon, which run only in the fall, the males are hook-jawed and red-blotched when they first enter the Strait of Fuca from the outside. The Humpback, taken in salt water about Seattle, have the same peculiarities. The male is slab-sided, hook-billed, and distorted, and is rejected by the canners. No hook-jawed females of any species have been seen. It is not positively known that any fully hook-jawed old male survives the reproductive act. If any do, the jaws must resume the normal form.

On first entering a stream the salmon swim about as if playing. They always head towards the current, and this appearance of playing may be simply due to facing the moving tide. Afterwards they enter the deepest parts of the stream and swim straight up, with few interruptions. Their rate of travel at Sacramento is estimated by Stone at about 2 miles per day; on the Columbia at about 3 miles per day. Those who enter the Columbia in the spring and ascend to the mountain rivers of Idaho, must go at a more rapid rate than this, as they must make an average of nearly four miles per day.

As already stated, the economic value of any species depends in great part on its being a "spring salmon." It is not generally possible to capture salmon of any species in large numbers until they have entered the rivers, and the spring salmon enter the rivers long before the growth of the organs of reproduction has reduced the richness of the flesh. The fall salmon can not be taken in quantity until their flesh has deteriorated; hence, the Dog Salmon is practically almost worthless, except to the Indians, and the Humpback Salmon is little better. The Silver Salmon, with the same breeding habits as the Dog Salmon, is more valuable, as it is found in the inland waters of Puget Sound for a considerable time before the fall rains cause the fall runs, and it may be taken in large numbers with seines before the season for entering the rivers. The Quinnat Salmon, from its great size and abundance, is more valuable than all the other fishes on our Pacific Coast taken together. The Blueback, similar in flesh, but much smaller and less abundant, is worth much more than the combined value of the three remaining species of salmon.

The fall salmon of all species, but especially of the Dog Salmon, ascend streams but a short distance before spawning. They seem to be in great anxiety to find fresh water, and many of them work their way up little brooks only a few inches deep, where they perish miserably, floundering about on the stones. Every stream, of whatever kind, has more or less of these fall salmon.

It is the prevailing impression that the salmon have some special instinct which leads them to return to spawn in the same spawning grounds where they were originally hatched. We fail to find any evidence of this in the case of the Pacific Coast salmon, and we do not believe it to be true. It seems more probably that the young salmon hatched in any river mostly remain in the ocean, within a radius of 20, 30, or 40 miles of its mouth. These, in their movements about in the ocean, may come into contact with the cold waters of their parent rivers, or, perhaps, of any other river, at a considerable distance from the shore. In the case of the Quinnat and the Blueback, their "instinct" seems to lead them to ascend these fresh waters, and, in a majority of cases, these waters will be those in which the fishes in question were originally spawned. Later in the season the growth of the reproductive organs leads them to approach the shore and search for fresh waters and still the chances are that they may find the original stream. But undoubtedly many fall salmon ascend, or try to ascend, streams in which no salmon were ever hatched. In little brooks about Puget Sound, where the water is not 3 inches deep, are often found dead or dying salmon, which have entered them for the purpose of spawning. It is said of the Russian River and other California rivers, that their mouths, in the time of low water in summer, generally become entirely closed by sand bars, and that the salmon, in their eagerness to ascend them, frequently fling themselves entirely out of water on the beach. But this does not prove that the salmon are guided by a marvelous geographical instinct, which leads them to their parent river in spite of the fact that the river can not be found. The waters of Russian River soak through these sand bars, and the salmon instinct, we think, leads them merely to search for fresh waters. This matter is much in need of further investigation; at present, however, we find no reason to believe that the salmon enter the Rogue River simply because they were spawned there, or that a salmon hatched in the Clackamas River is more likely, on that account, to return to the Clackamas than to go up the Cowlitz or the Des Chutes.

ONCORHYNCHUS:

*a*. Gill rakers comparatively short and few (20 to 25 in number).
  *b*. Scales very small, more than 200 in a longitudinal series; caudal spots large, oblong. GORBUSCHA, 773.
  *bb*. Scales medium, about 145 (138 to 155) in a longitudinal series; pyloric cœca about 150.
    *c*. Anal rays 13 or 14; black spots small or obsolete; B. 13 or 14. KETA, 774.
    *cc*. Anal rays about 16; back and upper fins with round black spots; B. 15 to 19. TSCHAWYTSCHA, 775.
  *bbb*. Scales comparatively large, about 130 (125 to 135) in a longitudinal series; pyloric cœca 50 to 80. KISUTCH, 776.

HYPSIFARIO, (ὕψι, high; *Fario*, trout):

*aa*. Gill rakers comparatively long and numerous (30 to 40 in number); scales large; lateral line about 130; back in adults unspotted, clear blue in spring, red in fall; young more or less spotted. NERKA, 777.

### Subgenus ONCORHYNCHUS.

### 773. ONCORHYNCHUS GORBUSCHA (Walbaum).

(HUMPBACK SALMON; HADDO; HOLIA; GORBUSCHA; DOG SALMON of Alaska.)

B. 11 or 12. Gill rakers 13 + 15. A. (developed rays) 15; D. 11; scales 215 (210–240), those of the lateral line larger, 170. Pyloric cœca very slender, about 180. Body rather slender, in the female plump and symmetrical, in the fall males very thin and comprêssed, with the fleshy dorsal hump much developed and the jaws much elongated, strongly hooked, and with extravagant canines in front. Ventral appendage half the length of the fin. Color bluish; sides silvery; back posteriorly, adipose fin, and tail with numerous black spots; those on the caudal fin particularly large and oblong in form; fall males red, more or less blotched with brownish. Weight 3 to 6 pounds. Pacific Coast and rivers of North America and Asia from Oregon northward; not rare; occasionally taken in the Sacramento * where it is called "Lost Salmon." Known at once by the very small size of the scales, and by the coarse oblong spots on the tail. (*Gorbuscha*, the Russian vernacular name in Alaska.)

*Salmo gorbuscha*, WALBAUM, Artedi Piscium, 69, 1792, Kamchatka; after the Gorbuscha of PENNANT and KRASCHENINNIKOW.

*Salmo gibber*, BLOCH & SCHNEIDER, Syst. Ichth., 409, 1801, Kamchatka; after KRASCHENINNIKOW.

*Salmo proteus*, PALLAS, Zoogr. Rosso-Asiatica, III, 376, 1811, Bering Sea; SUCKLEY, Monogr. Salmo, 97, 1861 (1874).

*Salmo scouleri*, RICHARDSON, Fauna Bor.-Amer., III, 158, 1836, Observatory Inlet.

*Salmo tschawytschiformis*, SMITT, I Riksmuseeum Befintliga Salmonider, 161, 1886, Port Clarence.

*Oncorhynchus proteus*, GÜNTHER, Cat., VI, 157, 1866.

*Oncorhynchus scouleri*, GÜNTHER, Cat., VI, 158, 1866.

*Oncorhynchus gorbuscha*, JORDAN & GILBERT, Synopsis, 305, 1883.

### 774. ONCORHYNCHUS KETA (Walbaum).

(DOG SALMON; HAY-KO; LE KAI SALMON.)

Head 4; depth 4. D. 9; A. 13 or 14; scales about 28–150–30; B. 13 or 14, rather broad; gill rakers 9 + 15; pyloric cœca 140–185. General form of the Quinnat, but the head proportionately longer, more depressed and pike-like; the preopercle more broadly convex behind, and the maxillary extending considerably beyond eye. Gill rakers few, coarse, and stout, as in the Quinnat. Accessory pectoral scale short, not half the length of fin. Dusky above; sides paler, little lustrous; back and sides with no defined spots, but only fine specklings, which are often entirely obsolete; head dusky, scarcely any metallic luster on head or tail; caudal dusky, plain, or very finely maculate, its edge usually distinctly blackish; fins all mostly blackish, especially in males; breeding males generally blackish above, with sides brick-red, often barred or mottled. Weight about 12 pounds. San Francisco to Kamchatka, ascending all streams in the fall, and spawning at no great distance from the sea; abundant in Bering Straits. At the time of its run the males of this species are much distorted and the flesh has little value. (*Keta*, a vernacular name in Kamchatka.)

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* This species appears in Alaska every year and in great abundance. In Puget Sound it comes each alternate year only, the odd year (1891, 1893, etc.). In the Sacramento each year, but in very small numbers. It ascends the Sacramento as far as Shasta County.

*Salmo keta vel kayko*, WALBAUM, Artedi Piscium, 72, 1792, Rivers of Kamchatka; after the *keta* or *kayko* of PENNANT and KRASCHENINNIKOW; BLOCH & SCHNEIDER, Syst. Ichth., 407, 1801.

*Salmo lagocephalus*, PALLAS, Zoogr. Ross.-Asiatica, III, 372, 1811, Bering Sea.

? *Salmo japonensis*, PALLAS, Zoogr. Ross.-Asiatica, III, 382, 1811, Curile Islands; Amur River.

*Salmo dermatinus*, RICHARDSON, Voyage Herald, Zoöl., 167, 1854, Yukon River.

*Salmo consuetus*, RICHARDSON, Voyage Herald, Zoöl., 168, 1854, Yukon River.

*Salmo canis*, SUCKLEY, Ann. Lyc. Nat. Hist. N. Y., 1858, 9, and Monogr. Salmo, 101, 1861 (1874),* Puget Sound.

*Oncorhynchus lagocephalus*, GÜNTHER, Cat., VI, 161, 1866.

*Oncorhynchus keta*, JORDAN & GILBERT, Synopsis, 305, 1883.

### 775. ONCORHYNCHUS TSCHAWYTSCHA (Walbaum).

(QUINNAT SALMON; TCHAVICHE; KING SALMON; COLUMBIA SALMON; SACRAMENTO SALMON; CHINOOK SALMON; TYEE SALMON; SAW-KWEY; TSCHAWYTSCHA.)

Head 4; depth 4. B. 15 or 16 to 18 or 19, the number on the two sides always unlike. D. 11; A. 16. Gill rakers usually 9 + 14 (*i. e.*, 9 above the angle and 14 below). Pyloric cœca 140 to 185; scales usually 27–146–29, the number in a longitudinal series varying from 140 to 155, and in California specimens occasionally as low as 135. Vertebræ 66. Head conic, rather pointed in the females and spring males. Maxillary rather slender, the small eye behind its middle. Teeth small, longer on sides of lower jaw than in front; vomerine teeth very few and weak, disappearing in the males. In the males in late summer and fall the jaws become elongate and distorted, and the anterior teeth much enlarged, as in the related species. The body then becomes deeper, more compressed, and arched at the shoulders, and the color often nearly black. Preopercle and opercle strongly convex. Body comparatively robust, its depth greatest near its middle. Ventrals inserted behind middle of dorsal, ventral appendage half the length of the fin; caudal, as usual in this genus, strongly forked, on a rather slender caudal peduncle. Color dusky above, often tinged with olivaceous or bluish; sides and below silvery; head dark slaty, usually darker than the body and little spotted; back, dorsal fin, and tail usually profusely covered with round black spots (these are sometimes few, but very rarely altogether wanting); sides of head and caudal fin with a peculiar metallic tin-colored luster; male, about the spawning season (October), blackish, more or less tinged or blotched with dull red. Flesh red and rich in spring, becoming paler in the fall as the spawning season approaches. Length 2 to 5 feet. Usual weight in the Columbia River 22 pounds, in the Sacramento 16 to 18 pounds; in smaller rivers still less, but individuals of 70 to 100 pounds have been taken. Alaska, Oregon, and California, southward to Ventura River, and to northern China, ascending all large streams; especially abundant in the Columbia and Sacramento rivers, where it is the principal salmon. It ascends† the large streams in spring and summer, moving up, without feeding, until the spawning season, by which time many of those which started first may have traveled more than 1,000 miles. It ascends the Snake River to the neighborhood of Upper Salmon Falls, where it spawns in October and November. In the Salmon River of Idaho it ascends to the head waters, more than 1,000 miles from the sea, where it spawns in August and early September when the water has reached a temperature of about 54° F. After spawning, most or all of those which have reached the upper waters perish from exhaustion. It is by far the most valuable of our salmon. It has lately been introduced into eastern streams. (*Tschawytscha*, better spelled by earlier writers *Tchaviche*, the vernacular name in Alaska and Kamchatka.)

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* Dr. Suckley's monograph of the genus Salmo was written in 1861, but not actually printed and published until 1874.

† The usual order of salmon running in the streams of Oregon and Washington is *nerka*, *tschawytscha*, *kisutch*, *gorbuscha*, and *keta*. Those which start first go farthest.

*Salmo tschawytscha*, Walbaum, Artedi Piscium, 71, 1792, rivers of Kamchatka; after the *Tschawitscha* of Krascheninnikow, Descr. Kamchatka, 178, 1768, and the *Tschawytscha* of Pennant, 1792; Bloch & Schneider, Syst. Ichth., 407, 1801.

*Salmo orientalis*, Pallas, Zoogr. Ross.-Asiat., III, 367, 1811, Kamchatka.

*Salmo quinnat*, Richardson, Fauna Bor.-Amer., III, 219, 1836, Columbia River; and of many writers.

*Fario argyreus*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 218, Cape Flattery; Fort Steilacoom.

*Salmo confluentus*, Suckley, Ann. Lyc. Nat. Hist. N. Y., December, 1858, and Pacific R. R. Surv., XII, Part 2, 334, 1860, Puyallup River, near Fort Steilacoom; (Coll. Suckley); and Monogr. Salmo, 109, 1861 (1874).

*Salmo argyreus*, Suckley, Pacific R. R. Surv., XII, Part 2, 326, 1860, and Monogr. Salmo, 110, 1861 (1874).

*Oncorhynchus quinnat*, Günther, Cat., VI, 158, 1866; Jordan, Proc. U. S. Nat. Mus., 1878, 69.

*Oncorhynchus orientalis*, Günther, Cat., VI, 159, 1866.

*Oncorhynchus chouicha*,† Jordan & Gilbert, Synopsis, 306, 1883.

### 776. ONCORHYNCHUS KISUTCH (Walbaum).

(Silver Salmon; Kisutch; Skowitz; Hoopid Salmon; Coho Salmon; Bielaya Ryba; Quisutsch.)

Head 4; depth 4. B. 13 or 14. Pyloric cœca very few and large, 63 (45 to 80); gill rakers 10 + 13, rather long and slender, nearly as long as eye, toothed; scales 25–127–29. D. 10; A. 13 or 14 (developed rays). Body rather elongate, compressed. Head short, exactly conical, terminating in a bluntly pointed snout, which is longer and broader than the lower jaw; head shorter than in a young Quinnat of the same size. Interorbital space broad and strongly convex. Opercle and preopercle strongly convex behind; the preopercle very broad, with the lower limb little developed; cheeks broad. Eye quite small, much smaller than in young Quinnat of the same size. Suborbital very narrow, with a row of mucous pores along its surface; maxillary slender and narrow, but extending somewhat beyond the eye. Teeth very few and small, only two or three on the vomer; those on tongue very feeble. Fins small. Pectorals and ventrals short, the ventral appendage three-fifths the length of the fin; caudal strongly forked, on a slender peduncle. Bluish green; sides silvery, with dark punctulations; no spots except a few rather obscure on top of head, back, dorsal fin, adipose fin, and the rudimentary upper rays of the caudal; rest of the caudal fin unspotted; pectorals dusky tinged; anal with dusky edging; sides of head without the dark coloration seen in the Quinnat; males mostly red in fall, and with the usual changes of form. Length 15 inches. Weight 3 to 8 pounds. A small salmon, ascending streams in the fall to no great distance. Abundant from San Francisco northward, especially in Puget Sound and the Alaskan fjords; south on the Asiatic coasts to Japan. (*Kisutch*, the vernacular name in Alaska and Kamchatka; called by the Russians *Bielaya Ryba*, or whitefish.)

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† An unsuccessful attempt at respelling the barbarous-looking word "*tschawytscha*."

? *Salmo milktschitch*, Walbaum, Artedi Piscium, 70, 1792, Bering Sea; after *Milktschutsch* or *Milktschitsch* of Pennant and Krascheninnikow; probably the young of *kisutch*.

*Salmo kisutch*,* Walbaum, Artedi Piscium, 70, 1792, Rivers and Lakes of Kamchatka; after the *Kisutch* of Pennant.

? *Salmo striatus*, Bloch & Schneider, Syst. Ichth., 407, 1801, Kamchatka; after *Milktschitsch* of Krascheninnikow.

*Salmo kysutch*, Bloch & Schneider, Syst. Ichth., 407, 1801, Kamchatka; after Pennant.

*Salmo sanguinolentus*, Pallas, Zoogr. Ross.-Asiat., III, 379, 1811, Bering Sea.

*Salmo tsuppitch*, Richardson, Fauna Bor.-Amer., III, 224, 1836, Columbia River; Günther. Cat., VI, 118, 1866.

? *Salmo macrostoma*, Günther, Amer. Mag. Nat. Hist., 1877, 444, Yokohama, Japan.

*Oncorhynchus lycaodon*, Günther, Cat., VI, 155, 1866; in part.

*Salmo scouleri*, Suckley, Monogr. Salmo, 94, 1861 (1874).

*Oncorhynchus sanguinolentus*, Günther, Cat., VI, 160, 1866.

*Oncorhynchus tsuppitch*, Jordan, Forest and Stream, September 16, 1880, 130

*Oncorhynchus kisutch*, Jordan & Gilbert, Synopsis, 307, 1883.

### Subgenus HYPSIFARIO, Gill.

### 777. ONCORHYNCHUS NERKA (Walbaum).

(Blue-back Salmon; Redfish; Fraser River Salmon; Saw-Qui Salmon; Krasnaya Ryba.

Head 4; depth 4. B. 13 to 15; D. 11; A. 14 to 16; scales 20–133–20; pyloric cœca 75 to 95; vertebræ 64. Gill rakers about 32 to 40, usually 14 or 15 + 22 or 23, as long as eye. Body elliptical, rather slender. Head short, sharply conic, pointed, the lower jaw included. Maxillary rather thin and small, extending beyond eye. Teeth all quite small, most of them freely movable; vomer with about 6 weak teeth, which grow larger in fall males, instead of disappearing. Preopercle very wide and convex; opercle very short, not strongly convex. Preopercle more free behind than in *O. tschawytscha*. Ventral scale about half the length of the fin. Caudal fin narrow, widely forked; anal fin long and low; dorsal low. Flesh deep red. Males becoming extravagantly hook-jawed in the fall, the snout being then prolonged and much raised above the level of rest of head, the lower jaw produced to meet it; mandible 1⅓ in head in fall males, 1¾ in females; snout 2¼ in head in fall males, 3½ in females. Color clear bright blue above; sides silvery, this hue overlying the blue of the back; lower fins pale, upper dusky; no spots anywhere in adults in spring; the young with obscure black spots above.

Color of breeding male: back blood red, with dark edges to some of the scales; middle of side darker red, but unevenly so, usually darkest at middle of body; under parts dirty white, with numerous fine dark dustings; head above and on sides pale olivaceous, some darker mottling on sides; tip of nose and sides of jaws dark, under part of lower jaw white; dorsal pale red, anal darker red; adipose fin red; ventrals and pectorals smoky, some red at base. Color of breeding female essentially the same, rather darker on the sides. Length 2 feet; weight 3½ to 8 pounds. Klamath and Rogue rivers northward to Kamchatka and Japan; generally abundant, especially northward; ascending streams in spring to great distances, and often frequenting mountain lakes in fall, spawning in their small tributaries; one of the most graceful of the *Salmonidæ*, scarcely inferior to the Quinnat when fresh, but the flesh more watery and less valuable when canned. The principal salmon of Alaska.

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* Misprinted *hisutch* by Walbaum, the error corrected in the errata. The name *milktschitsch* has a few lines of priority over *kisutch*, but we are not absolutely sure that it belongs to the same species.

The Redfish is known to ascend to the small lakes of Alaska, British Columbia, Washington, Oregon, and Idaho, and to spawn in their inlets. Dr. Bean has observed it at Karluk Lake in Alaska, Dr. Dawson and Prof. John Macoun in British Columbia, Prof. O. B. Johnson at Lake Washington, Dr. Gilbert at Wallowa Lake in Oregon, while we have recently studied it on its spawning beds in the inlets to Alturas, Pettit, and Big Payette lakes in Idaho. This species enters the Columbia River with the spring run of the Chinook Salmon, but does not reach the lakes of Idaho until August. We observed them spawning in the shallow water of the inlets on beds of fine gravel and sand, which they scoop up into considerable heaps. The temperature of the water at Alturas and Pettit lakes, September 12, was 45° F., and the same temperature was found at Big Payette Lake September 27.

Two distinct and widely different sizes of the Redfish are found sexually mature, the large form described above, and a small form which is mature at a foot or less in length; and no specimens of intermediate size have been observed. The average weight of six spawning fish of the large form examined at Alturas Lake was 3 pounds 3½ ounces, the minimum and maximum being 2 pounds 5 ounces (a spent female), and 3 pounds 10½ ounces. The average weight of twenty-nine individuals of the small form obtained the same day and from the same stream was 6⅓ ounces, the extremes being 4½ (a spent female) and 9 ounces, respectively.

These little fish, which have been known as the Little Redfish or Kennerly's Salmon, have been regarded as being a landlocked variety, distinct from *O. nerka*. We are not able to discover any structural differences between the two. We have found them breeding at the same time and in the same stream. The mutilations and frayed-out fins point to the probability of their having made the long journey from the sea; indeed, Dr. Gilbert has traced their migration from the mouth of the Columbia to Wallowa Lake. There is no more evidence that they are landlocked than that the large ones are, and if they are not younger individuals of the regular *nerka*, they should be assigned specific rather than subspecific rank.

The fins of the little Redfish were observed to be frayed out and mutilated quite as generally as were those of the large ones, and many dead ones of each size were seen. It is doubtful if any which ascend to the Idaho lakes ever return to the sea, but all probably die after spawning.

The color of the breeding male of the small form is dirty red, brightest on middle of side; back with about 15 round black spots before the dorsal and an equal number behind it; lower parts colored as in the large fish; top and sides of head dark greenish olive; snout black; lower jaw white, with black tip; dorsal pale red; anal dirty red; other fins dark smoky. Female darker than the male; not greatly different in color from the black speckled trout. (*nerka*, a Russian name.)

*Salmo nerka*, WALBAUM, Artedi Piscium, 71, 1792; after the *Nerka* of PENNANT, the *Narka* of KRASCHININNIKOW, rivers and seas of Kamchatka; BLOCH & SCHNEIDER, Syst. Ichth., 417, 1801; after PENNANT and KRASCHININNIKOW.

*Salmo lycaodon*, PALLAS, Zoogr. Rosso-Asiat., III, 370, 1811, Ochotsk Sea; Kamchatka

*Salmo paucidens*, RICHARDSON, Fauna Bor.-Amer., III, 222, 1836, Columbia River.

*Salmo tapdisma*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XXI, 365, 1848, Kamchatka; on a drawing.

*Salmo arabatsch*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XXI, 365, 1848, Kamchatka; on a drawing.

*Salmo melampterus*, CUVIER & VALENCIENNES, XXI, *l. c.*, 365, 1848, Kamchatka; on a drawing.

*Salmo kennerlyi*, SUCKLEY, Ann. Lyc. Nat. Hist. N. Y., VII, 1861, 307, Chiloweyuck Lake: (Type, No. 2092. Coll. Kennerly); SUCKLEY, Monogr. Salmo, 145, 1861 (1874); GÜNTHER, Cat., VI, 120, 1866.

*Salmo cooperi*, SUCKLEY, Notices New Species N. A. Salmon, New York, June, 1861, and Monogr. Salmo, 99, 1861 (1874), Okanogan River. (Coll. Geo. Gibbs.)

*Salmo warreni*, SUCKLEY, *l. c.*, June, 1861, and *l. c.*, 147, 1861 (1874), Fraser River, British Columbia. (Type, Nos. 2070 and 2073. Coll. Kennerly.)

*Salmo richardi*, SUCKLEY, *l. c.*, June, 1861, and *l. c.*, 117, 1861 (1874), Fraser and Skagit rivers. (Type, No. 2005.)

*Hypsifario kennerlyi*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 330.

*Oncorhynchus lycaodon*, GÜNTHER, Cat., VII, 155, 1866.

*Oncorhynchus paucidens*, GÜNTHER, Cat., VII, 158, 1866.

*Oncorhynchus nerka*, JORDAN & GILBERT, Synopsis, 308, 1883.

*Oncorhynchus nerka kennerlyi*, BEAN, Forest and Stream, July 9, 1891.

## 235. SALMO (Artedi) Linnæus.

(SALMON AND TROUT.)

*Salmo* (ARTEDI, Genera Piscium) LINNÆUS, Syst. Nat., Ed. x, 1758, 308, (*salar*, etc).

*Truttæ*, LINNÆUS, Syst. Nat., Ed. x, 1758, 308, (*trutta*, etc.: "*Truttæ corpore variegato*").

*Fario*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XXI, 277, 1848, (*argenteus* = *trutta*).

*Salar*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XXI, 314, 1848, (*ausonii* = *fario*).

*Trutta*, SIEBOLD, Süsswasserfische Mittel Europa, 280, 1863, (*trutta*).

Body elongate, somewhat compressed. Mouth large; jaws, palatines, and tongue toothed, as in related genera; vomer flat, its shaft not depressed, a few teeth on the chevron of the vomer, behind which is a somewhat irregular single or double series of teeth, which in the migratory forms are usually deciduous with age. Scales large or small, 110 to 200 in a longitudinal series. Dorsal and anal fins short, usually of 10 to 12 rays each; caudal fin truncate, emarginate or forked, its peduncle comparatively stout. Sexual peculiarities variously developed; the males in typical species with the jaws prolonged and the front teeth enlarged, the lower jaw being hooked upward at the end and the upper jaw emarginate or perforate. In the larger and migratory species these peculiarities are most marked. Species of moderate or large size, black-spotted, abounding in the rivers and lakes of North America, Asia, and Europe; no fresh-water species occurring in America east of the Mississippi Valley; two Atlantic species, marine and anadromous. The non-migratory species (subgenus *Trutta*) are in both continents extremely closely related, and difficult to distinguish, if indeed all be not necessarily regarded as forms of a single one. The excessive variations in color and form have given rise to a host of nominal species.* (*Salmo*, the Latin name of *Salmo salar*, originally from *salio*, to leap.)

The following observations on the species of trout are taken, with some slight abridgment and alteration, from Dr. Günther's account of this family. (Cat. Fish. Brit. Mus., VI, 3–5, 1866):

There is no other group of fishes which offers so many difficulties to the ichthyologist, with regard to the distinction of the species, as well as to certain points in their life history, as this genus. * * * The almost infinite variations of these fishes are dependent on age, sex, and sexual development, food, and the properties of the water. * * * The coloration is, first of all, subject to variation, and consequently this character but rarely assists in distinguishing a species, there being not one which would show in all stages the same kind of coloration. The young in all the species of this genus are barred, and this is so constantly the case that it may be used as a generic or even as a family character, not being peculiar to *Salmo* alone, but also to *Thymallus* and probably to *Coregonus*. The number of bars is not quite constant, but the migratory trout have two (or even three) more than the river trout. When the *Salmones* have passed this "parr" state the coloration becomes much diversified. The males, especially during and immediately after the spawning time, are more intensely colored and variegated than the females, specimens not mature retaining a brighter silvery color, and being more similar to the female fish. Food appears to have less influence on the coloration of the outer parts than on that of the flesh; thus, the more variegated specimens are frequently out of condition, whilst well-fed individuals, with pinkish flesh, are of more uniform though bright colors. * * * The water has a marked influence on the colors. Trout with intense ocellated spots are generally found in clear, rapid rivers and in alpine pools; in the large lakes, with pebbly bottom, the fish are bright silvery, and the ocellated spots are mixed with or replaced by X-shaped black spots; in dark holes, or lakes with peaty bottom, they often assume an almost uniform blackish coloration.

The brackish or salt water has the effect of giving them a bright silvery coat, without or with few spots, none of them ocellated. With regard to size, the various species do not present an equal amount of variation. Size appears to depend upon the abundance of the food and the extent of the water. Thus, the migratory species do not appear to vary considerably in size, because they find the same conditions in all the localities inhabited by them. A widely-spread species, however, like *Salmo fario* [or in America, *Salmo mykiss*], when it inhabits a small mountain pool, with scanty food, never attains a weight of 8 ounces, while in a large lake or river, where it finds an abundance of food, it attains to a weight of 14 or 16 pounds. Such large river trout are frequently named or described as Salmon trout, Bull trout, Steelheads, etc.

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* European writers have described numerous hybrids among the various species of *Salmo*, real and nominal, found in their waters; as also among the various European *Cyprinidæ*. We have thus far failed to find the slightest evidence of any hybridism either among our American *Salmonidæ* or *Cyprinidæ*, in a state of nature. Puzzling aberrant or intermediate specimens certainly occur, but such are not necessarily "hybrids."

The proportion of the various parts of the body to one another vary exceedingly, in the same species, with age, sex, and condition.

The fins vary to a certain degree. The variation in the number of rays in any one genus (except *Oncorhynchus*) is inconsiderable, and of no value for specific distinction. Although some species appear to be distinguished by a comparatively low dorsal and anal fin, yet the proportion of the height of these fins to their length is a rather uncertain character. In most of the species the fin rays are longer during the stages of growth or development. The caudal fin especially undergoes changes with age. Young specimens of all species have this fin more or less deeply excised, so that the young of a species which has the caudal emarginate throughout life is distinguished by a deeper incision of the fin from the young of a species which has it truncate in the young state. The individuals of the same species do not all attain to maturity at the same size.

Finally, to complete our enumeration of these variable characters, we must mention that in old males, during and after the spawning season, the skin on the back becomes thickened and spongy, so that the scales are quite invisible or hidden in the skin.

After this cursory review of variable characters, we pass on to those which we have found to be constant in numbers of individuals, and in which it is difficult to perceive signs of modification due to external circumstances.

Such characters, according to the views of the zoölogists of the present age, are sufficient for the definition of species; at all events, in every description they ought to be noticed, and the confused and unsatisfactory state of our knowledge of Salmonoids is chiefly caused by authors having paid attention to the more conspicuous but unreliable characters, and but rarely noted one of those which are enumerated here:

1. The form of the preoperculum of the adult fish.
2. The width and strength of the maxillary of the adult fish. In young specimens and in females the maxillary is proportionately shorter than in the adult.
3. The size of the teeth, those of the premaxillaries excepted.
4. The arrangement and permanence of the vomerine teeth.
5. The development or absence of teeth on the hyoid bone. In old examples these are often lost, and their absence in a species usually provided with them is not uncommon.
6. The form of the caudal fin in specimens of a given size, age, or sexual development.
7. The size of the scales, as indicated by counting the number of transverse rows above the lateral line. The scales of the lateral line are always more or less enlarged or irregular and the number of scales should be ascertained higher up; this is one of the most constant and valuable of all the specific characters.
8. A great development of the pectoral fins, when constant in a number of specimens from the same locality.

9. The number of vertebræ.
10. The number of pyloric cœca.
11. The number of gill rakers.

Salmo. Salmon; species anadromous:

*a.* The vomerine teeth little developed, those on the shaft of the bone few and deciduous; scales large, about 120 in the lateral line; no hyoid teeth; sexual differences strong; breeding males with the lower jaw hooked upward, the upper jaw emarginate or perforate to receive its tip. Size large. SALAR, 778.

Trutta (Low Latin *Trutta*, French *Truite*, hence Trout). Trout; species not anadromous or only partially so:

*aa.* The vomerine teeth well developed, those on the shaft of the bone numerous, persistent, arranged in one zigzag row, or in two alternating rows; sexual differences less marked, but similar in general character to those seen in the salmon.

*b.* Scales always small, usually about in 160 (150 to 200) cross series; a large deep red or scarlet dash on each side concealed below the inner edge of each dentary bone, this rarely obsolete; lower fins red or yellowish; usually no red lateral band; mouth large, the maxillary 1⅗ to 2¼ in head; hyoid teeth (on hypobranchial of second gill arch) usually present, but very small; size various. MYKISS, 779.

*bb.* Scales moderate, usually about in 150 cross series (130 to 180); no red dash on dentaries; a reddish lateral band usually present; form rather stout; mouth moderate, the maxillary 2 in head; hyoid teeth wanting so far as known; size very large. GAIRDNERI, 780.

*bbb.* Scales typically large, in 120 to 130 cross series, but varying from 115 to 180; usually no red on dentaries; a red or yellow lateral band; form stout; mouth small, the maxillary 2 to 2½ in head; no hyoid teeth; size rather small. IRIDEUS, 781.

### Subgenus SALMO.

### 778. SALMO SALAR, Linnæus.

(Common Atlantic Salmon.)

Head 4; depth 4. B. 11; D. 11; A. 9; scales 23–120–21; vertebræ 60; pyloric cœca about 65. Body moderately elongate, symmetrical, not greatly compressed. Head rather low. Mouth moderate, the maxillary reaching just past the eye, its length 2½ to 3 in head; in young specimens the maxillary is proportionately shorter. Preoperculum with a distinct lower limb, the angle rounded. Scales comparatively large, rather largest posteriorly, silvery and well imbricated in the young, becoming embedded in adult males. Coloration in the adult, brownish above, the sides more or less silvery, with numerous black spots on sides of head, on body, and on fins, and red patches along the sides in the males; young specimens (parrs) with about 11 dusky crossbars, besides black spots and red patches; the color, as well as the form of the head and body, varying much with age, food, and condition; the black spots in the adult often **X**-shaped or **XX**-shaped. Weight 15 to 40 pounds. North Atlantic, ascending all suitable rivers in northern Europe and the region north of Cape Cod to Hudson Bay; formerly abundant in the Hudson and occasional in the Delaware, its northern limit in the Churchill, Albany, and Moose rivers, flowing into Hudson Bay; sometimes perfectly landlocked in lakes in Maine and northward, where its habits and coloration (but no tangible specific characters) change somewhat, when it becomes (in America) vars. *sebago* and *ouananiche.* Similar landlocked varieties occur in Europe. One of the best known and most valued of food-fishes, the flesh rich and oily; orange or "salmon color" when the fish is in condition. (*Salar*, an old name, from *salio*, to leap.)

*Salmo salar*, LINNÆUS, Syst. Nat., Ed. x, 1758, 308, Seas of Europe; GÜNTHER, Cat., VI, 11, 1866, and of nearly all authors; SUCKLEY, Monogr. Salmo, 143, 1861 (1874); JORDAN & GILBERT, Synopsis, 312, 1883.

*Salmo mas*, WALBAUM, Artedi Pisc., 58, 1792, Germany; based on "Der Hakenlachs" of BLOCH.

*Salmo omisco maycus*, WALBAUM, Artedi Pisc., 65, 1792, Hudson Bay; after PENNANT, Arctic Zoöl., Introd., 192, 1792.

*Salmo gloveri*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 85, Union River, Maine; (Coll. M. Townsend Glover); GÜNTHER, Cat., VI, 153, 1866.

Represented in lakes of Maine, New Hampshire, and New Brunswick by the landlocked

### 778a. SALMO SALAR SEBAGO (Girard).

(LANDLOCKED SALMON.)

Smaller in size, rather more plump in form, and nonmigratory, not otherwise evidently different. Sebago Pond and northward, introduced into lakes in various parts of the country; seldom entering streams; reaches a weight of 25 pounds.

*Salmo sebago*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1853, 380, Sebago Lake, Maine; GÜNTHER, Cat., VI, 153, 1866.

Represented in Lake St. John, Saguenay River, and neighboring waters of Quebec by the landlocked

### 778b. SALMO SALAR OUANANICHE, McCarthy MS., new subspecies.

(OUANANICHE; WINNINISH.)

Still smaller, rarely reaching a weight of 7½ pounds and averaging 3½. An extremely vigorous and active fish, smaller and more active than ordinary salmon, but so far as known not structurally different. Saguenay River, Canada (outlet of Lake St. John), and neighboring waters. (*Ouananiche*,* the Indian name.)

*Ouananiche*,† EUGENE MCCARTHY, Forest and Stream, March 10, 1894, 206, Saguenay River; and of anglers generally.

## Subgenus TRUTTA, Linnæus.

### 779. SALMO MYKISS, Walbaum.

(CUT-THROAT TROUT; BLACK-SPOTTED TROUT; ROCKY MOUNTAIN TROUT; SA-PEN-QUE, OR GOOD FISH.)

Scales in general smaller than in the European Trout,‡ *Salmo trutta*, the number of oblique cross series counted above the lateral line varying from 160 to 190. Back and sides with dark spots. Caudal fin subtruncate or with shallow fork.

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* The word ouananiche is from the dialect of the Montagnais Indians who inhabit the country about Lake St. John. They have always been familiar with this fish, and, understanding its derivation, have properly named it "*ouanan*," meaning salmon, and "*ichi*," the diminutive—"the little salmon."—*McCarthy.*

† "The Ouananiche were born and grew to full size in the rough tributaries and outlet of Lake St. John, in waters than which none can be wilder or more rough. They are found where the water boils and tumbles the most, rarely in still water. * * * They are a terribly strong fish, able to ascend through the swiftest current or mount the wildest fall. * * * Born of fighting stock, he fights his native element constantly, and he fights his foe, the fisherman, as well. * * * There is nothing that can make me believe that any fish can exceed, or even equal, quite, the king of fresh-water fish, the gamiest of all, the Ouananiche of Lake St. John."—*McCarthy.*

‡ *Salmo trutta*, L., the half migratory Salmon Trout, and its fresh-water representative or subspecies, the Brook Trout or Brown Trout, *Salmo fario*, L. This species, with some of its varieties (for example, the Loch Leven Trout, var. *levenensis*), has been largely introduced in the streams and lakes of the United States.

A very widely distributed species, found in all clear streams of the Rocky Mountains and Sierra Nevada, from Kamchatka and Alaska to Chihuahua and northern California, and often entering the sea. It is exceedingly variable, being subject to many local changes, and its extreme forms show a degree of variation rarely met within the limits of a single species.

Among the various more or less tangible varieties and forms of American trout, three distinct series appear which we here provisionally retain as distinct species; these may be termed the Cut-throat Trout series, the Steelhead series, and the Rainbow Trout series. The Steelhead series, *Salmo gairdneri*, is characterized by moderate scales (150 to 180 series), moderate mouth, red lateral band and the absence of red between the branches of the lower jaw. The *irideus* or Rainbow Trout series has usually large scales, small mouth, a red lateral band and usually no red below the lower jaw. The Cut-throat Trout, *Salmo mykiss*, in its various forms, has smaller scales (150 to 190 series), a larger mouth, always a distinct red blotch between the branches of the lower jaw, and usually no red lateral band.

The Steelhead or *gairdneri* series is found in the coastwise streams of California and in the streams of Oregon and Washington, below the Great Shoshone Falls of the Snake River. In the lower course of the Columbia, and in neighboring waters, they are entirely distinct from the "Cut-throat" or *mykiss* forms, and no one could question the validity of the two species. In the lower Snake and in other waters east of the Cascade range, the two forms or species are indistinguishable, being either undifferentiated or else inextricably mingled. The proper interpretations of these facts, lately discovered by Dr. Gilbert, is yet to be shown. The *irideus* forms are chiefly confined to the streams of California and Oregon. The *mykiss* series inhabit the waters from Humboldt Bay northward, the coastwise streams of northern California, the head waters of the Columbia and Snake rivers, and all the clear streams on both sides of the Rocky Mountains, and in the Great Basin.

Along the western slope of the Sierra Nevada there are also forms of trout with the general appearance of *gairdneri*, but with scales intermediate in number (McCloud River), or with scales as small as in the typical *mykiss* (Kern River). In these smaller-scaled forms more or less red appears below the lower jaw, and they are doubtless in fact what they appear to be, really intermediate between *mykiss* and *gairdneri*. A similar series of forms occurs in the Columbia Basin, the Upper Snake being inhabited by *mykiss*, the lower basin of the Snake, as above stated, by *gairdneri* and *mykiss*, together with a medley of intermediate forms.

Concerning the trout of the Upper Columbia Basin, Gilbert and Evermann observe (Investigations Columbia River Basin, 50, 1894):

> "With every additional collection of black-spotted trout it becomes increasingly difficult to recognize any of the distinctions, specific or subspecific, which have been set up. The present collection [from Idaho and Washington] adds not a little to the difficulty. We are now convinced that the greater number of the subspecies of *Salmo mykiss* have no sufficient foundation.

We find our specimens from the Upper Snake River (Ross Fork and Mink Creek at Pocatello) to be typical *mykiss* [*Salmo mykiss lewisi* of the present work; see page 493], having smaller scales, in 176 to 180 transverse rows, and a deep-red dash on inner side of mandibles. The spots are most abundant posteriorly, and the specimens are scarcely to be distinguished from the so-called *Salmo mykiss pleuriticus* of the Colorado River. When taken in the larger river channels the fish is lighter colored, with finer spots and fainter red marks on lower jaw.

"Between such typical *mykiss* and the form represented in our collection from such coastwise streams [*Salmo irideus masoni* of this work; see page 501], as the Newaukum River at Chehalis, Washington, there seems to be a wide difference. The latter has conspicuously larger scales (in 120 to 130 crossrows) and no red streak on lower jaw. The sea-run individuals of the latter kind we believe to be the Steelhead (*S. gairdneri*), and between it and the *mykiss* we are now unable to draw any sharp line. Thus the specimens from Wood River, Idaho, have fine scales (150 to 163 transverse rows) and have usually no red dash under the jaw. Some specimens show traces of the latter, and in such it is usually faint and irregular. From the Umatilla River at Pendleton, the Natches River at North Yakima, and the Pataha River at Starbuck, Washington, the scales are intermediate in size, ranging from 142 to 163 in number, averaging perhaps 148. In these [*Salmo mykiss gibbsii* of this work; see page 493] the lower jaw shows no red.

"Specimens from the Cœur d'Alene region have the red dashes usually very distinct, but vary greatly in the size of their scales. Examples from Wardner look much like typical *mykiss*, with 165 to 170 scales. From Cœur d'Alene Lake we find 130 to 166, with the average about 145, while from the Little Spokane River at Dart's Mill specimens with conspicuous red dash on mandibles have the scales averaging 125 in number.

"Trout from the Green River at Hot Springs, Washington, and from the Newaukum River at Chehalis have also 123 to 130 scales. We think it not unlikely that the coastwise forms should be recognized as *Salmo mykiss gairdneri*, though the question is sadly in need of systematic and thorough investigation."—*Gilbert & Evermann.*

Since the above was written, Dr. Gilbert has verified the fact discovered by him in 1880, that in the streams about Astoria, near the mouth of the Columbia, *Salmo mykiss* and *Salmo gairdneri* occur together and are perfectly distinct and both easily and unquestionably distinguishable from a third form, here called *masoni*, found in the brooks of the same region and not descending to the sea. As already stated, the interpretation of these facts is yet to be given.

It seems not improbable that the American Trout originated in Asia, extended its range southward to the Upper Columbia, thence to the Yellowstone and Missouri; from the Missouri southward to the Platte and the Arkansas, thence from the Platte to the Rio Grande and the Colorado, and from the Colorado across the Sierra Nevada to Kern River,* thence northward and coastwise, the sea-running forms passing from stream to stream, as far north as Frazer River, where the variety *kamloops* would mark one extreme of the series, and reentering as a distinct species the waters long occupied by typical *mykiss*. The present writers have elsewhere† shown that, beyond a doubt, the Trout of the Yellowstone and the Upper Missouri is derived directly from that of the Upper Snake River. To this day the Yellowstone and the Snake are connected by two streams crossing the main divide of the Rocky Mountains from the Yellowstone to the Snake across Two-Ocean Pass.

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* It may be that the trout of the Sierra Nevada in California originated from the Lahontan stock (*Salmo mykiss henshawi*), rather than from the Colorado River. There are localities between the Truckee Valley and that of the American River or the Feather River, where it is conceivable that such a transfer might have taken place. Or it may be that the California trout are descended through the Steelhead from the trout of the Middle Columbia. This interesting subject merits the fullest investigation. (See Jordan, on How the Trout came to California, in Recreation, Vol. I, No. 1, October, 1894, 5–11.)

† Evermann, A Reconnaissance of the Streams and Lakes of western Montana and northwestern Wyoming, in Bull. U. S. Fish Comm., XI, 1891, 24–28, pls. I and II.
Jordan, The Story of a Strange Land, in Pop. Sci. Month., Feb., 1892, 447–458.
Evermann, Two-Ocean Pass, in Proc. Ind. Ac. Sci., 1892, 29–34, pl. I.
Evermann, Two-Ocean Pass, in Pop. Sci. Month., June, 1895, with plate.

Professor Evermann has elsewhere described the locality as follows:

Two-Ocean Pass is a high mountain meadow, about 8,200 feet above the sea and situated just south of the Yellowstone National Park, in longitude 110° 10′ W., latitude 44° 3′ N. It is surrounded on all sides by rather high mountains except where the narrow valleys of Atlantic and Pacific creeks open out from it. Running back among the mountains to the northward are two small canyons down which come two small streams. On the opposite side is another canyon down which comes another small stream. The extreme length of the meadow from east to west is about a mile, while the width from north to south is not much less. The larger of the streams coming in from the north is Pacific Creek, which, after winding along the western side of the meadow, turns abruptly westward, leaving through a narrow gorge. Receiving numerous small affluents, Pacific Creek soon becomes a good-sized stream, which finally unites with Buffalo Creek a few miles above where the latter stream flows into Snake River.

Atlantic Creek was found to have two forks entering the pass. At the north end of the meadow is a small wooded canyon down which flows the North Fork. This stream hugs the border of the flat very closely. The South Fork comes down the canyon on the south side, skirting the brow of the hill a little less closely than does the North Fork. The two, coming together near the middle of the eastern border of the meadow, form Atlantic Creek which, after a course of a few miles flows into the Upper Yellowstone. But the remarkable phenomena exhibited here remain to be described.

Each fork of Atlantic Creek, just after entering the meadow, divides as if to flow around an island, but the stream toward the meadow, instead of returning to the portion from which it had parted, continues its westerly course across the meadow. Just before reaching the western border the two streams unite and then pour their combined waters into Pacific Creek; thus are Atlantic and Pacific creeks united and a continuous water way from the Columbia via Two-Ocean Pass to the Gulf of Mexico is established.

Pacific Creek is a stream of good size long before it enters the pass, and its course through the meadow is in a definite channel, but not so with Atlantic Creek. The west bank of each fork is low and the water is liable to break through anywhere and thus send part of its water across to Pacific Creek. It is probably true that one or two branches always connect the two creeks under ordinary conditions, and that following heavy rains or when the snows are melting, a much greater portion of the water of Atlantic Creek crosses the meadow to the other side.

Besides the channels already mentioned, there are several more or less distinct ones that were dry at the time of our visit. As already stated the pass is a nearly level meadow, covered with a heavy growth of grass and many small willows 1 to 3 feet high. While it is somewhat marshy in places it has nothing of the nature of a lake about it. Of course during wet weather the small springs at the borders of the meadow would be stronger, but the important facts are that there is no lake or even marsh there and that neither Atlantic nor Pacific Creek has its rise in the meadow. Atlantic Creek in fact comes into the pass as two good-sized streams from opposite directions and leaves it by at least four channels, thus making an island of a considerable portion of the meadow. And it is certain that there is, under ordinary circumstances, a continuous water way through Two-Ocean Pass of such a character as to permit fishes to pass easily and readily from Snake River over to the Yellowstone, or in the opposite direction. Indeed, it is quite possible, barring certain falls in the Snake River, for a fish so inclined to start at the mouth of the Columbia, travel up that great river to its principal tributary, the Snake, thence on through the long, tortuous course of that stream, and, under the shadows of the Grand Teton, enter the cold waters of Pacific Creek, by which it could journey on up to the very crest of the Great Continental Divide,—to Two-Ocean Pass; through this pass it may have a choice of two routes to Atlantic Creek, in which the down-stream journey is begun. Soon it reaches the Yellowstone, down which it continues to Yellowstone Lake, then through the lower Yellowstone out into the turbid waters of the Missouri; for many hundred miles it may continue down this mighty river before reaching the Father of Waters, which will finally carry it to the Gulf of Mexico—a wonderful journey of nearly 6,000 miles—by far the longest possible fresh-water journey in the world.

We found trout in Pacific Creek at every point where we examined it. In Two-Ocean Pass we found trout in each of the streams and in such positions as would have permitted them to pass easily from one side of the divide to the other. We also found trout in Atlantic Creek below the pass, and in the upper Yellowstone they were abundant. Thus it is certain that there is no obstruction, even in dry weather, to prevent the passage of trout from the Snake River to

Yellowstone Lake; it is quite evident that trout do pass over in this way; and it is almost certain that Yellowstone Lake was stocked with trout from the west via Two-Ocean Pass.

The trout of the great basin of Utah (Lake Bonneville), is descended from the trout of the Upper Snake (*lewisi*) which is not evidently different from typical *mykiss*; the fish fauna of Lake Bonneville and the Upper Snake being still virtually identical, the disappearance of the outlet of Lake Bonneville to the north having taken place in times comparatively recent. The trout of the Nevada Basin (Lake Lahontan) is apparently descended from typical *mykiss*, the outlet of that lake having entered the Columbia below the Snake River falls, and its disappearance being no doubt of earlier date. The faunas of lakes Bonneville and Lahontan at present have little in common. Almost nothing is known of the Tertiary Lake Idaho, now represented by lakes Malheur, Warner, Goose, etc.

In any event, whether this hypothetical line of descent be true or not, the fact remains that nowhere in the series can we place an absolute line of separation between *Salmo mykiss* and *Salmo gairdneri*, and they approach each other most closely in southeastern California, and in the Middle Columbia.

We arrange the subspecies in accordance with the above suggestions, leaving each recognizable variation, for the time being, with the title of subspecies. Some of them, as *macdonaldi* and *agua-bonita*, may ultimately be ranked as species, on account of their local isolation and consequently better defined characters, while others may prove wholly undefinable.

It is not unlikely, that when the waters of the Northern Hemisphere are fully explored, it will be found that all the black-spotted trout of America, Europe, and Asia are forms of one species, for which the oldest name is *Salmo trutta*, Linnæus.

The various subspecies or varieties of the *Salmo mykiss* group which we are able to distinguish with more or less certainty are given in the following analysis:

*a.* Black spots almost as numerous on the head as on the posterior part of body. (Northwestern forms.)
  *b.* Scales usually about 160 to 170.
    *c.* Spots rather large, profusely scattered and irregular, usually none on the belly.
      *d.* Red marks under the dentary bones always present. MYKISS; CLARKII; LEWISI, 779–779b.
      *dd.* Red marks under dentary bones obsolete or nearly so. GIBBSII, 779c.
    *cc.* Spots rather large, sparsely scattered, some present on the belly and on lower side of head; adult with elongate spots; head slender and conical. Lake Tahoe (Basin of Lake Lahontan.) HENSHAWI, 779d.
  *bb.* Scales larger, usually about 145; spots numerous but rather small. Great Basin (Lake Bonneville Basin.) VIRGINALIS, 779e.
*aa.* Black spots chiefly placed on the posterior half of body. Red blotch on dentary bones conspicuous. (Southwestern forms.)
  *e.* Scales not very small, about 160; spots of moderate size. (Rio Grande Basin.) SPILURUS, 779f.
  *ee.* Scales very small, about 180.
    *f.* Spots rather large; lower fins distinctly red, rarely orange.
      *g.* Spots very numerous; a red lateral band. (Colorado Basin.) PLEURITICUS, 779g.
      *gg.* Spots less numerous, none anteriorly. (Lake Waha, Washington.) BOUVIERI, 779h.

*ggg.* Spots few and large, chiefly on the tail; opercles more curved than in *bouvieri.* (Head waters of Arkansas and Platte rivers.) STOMIAS, 779i.

*ff.* Spots all small; lower fins bright yellow; a yellow lateral shade. (Twin Lakes, Colorado.) MACDONALDI, 779j.

The typical form from Alaska, Bering Sea, and Kamchatka is

### 779. SALMO MYKISS, Walbaum.

(MYKISS; CUT-THROAT TROUT.)

Head 4; depth 4. D. 10; A. 10. Cœca 43. Scales small, variable in size, about 39–165 to 170–30. Body moderately elongate, compressed. Head rather short. Mouth moderate, the maxillary not reaching far beyond the eye. Vomerine teeth as usual, set in an irregular zigzag series; teeth on the hyoid (second hypobranchial) normally present, but often obsolete, especially in old examples. Dorsal fin rather low; caudal fin slightly forked, (more so in young individuals than in the adult, as in all trout). Back and caudal peduncle profusely covered with rounded black spots of varying size; dorsal, caudal, and adipose fin covered with small spots about as large as the nostril; a few spots on the head; belly rarely spotted; inner edge of the mandibles below with a deep-red blotch. Sea-run specimens are nearly uniform silvery; males with a lateral band and patches of light red; lower fins largely red; extremely variable in color and form. The common trout of all the streams of Alaska and Kâmchatka, where it descends to salt water, and reaches a considerable size. The black-spotted trout of British Columbia is probably of the same type, and no character is known by which the similar form in the lower Columbia may be separated. The red blotches on the lower jaw between the dentary bones on the membrane joining them is usually constant and characteristic. (*Mykiss*, a vernacular name of the species in Kamchatka.)

*Mykiss*, PENNANT, Arctic Zoölogy, Introd., 126, 1792, Kamchatka; after KRASCHENINNIKOW, etc.

*Salmo mykiss*, WALBAUM, Artedi Piscium, 59, 1792, Kamchatka; based on *Mykiss* of PENNANT.

*Salmo muikisi*, BLOCH & SCHNEIDER, Syst. Ichth., 419, 1801, Kamchatka; after STELLER.

*Salmo purpuratus*, PALLAS, Zoöl. Ross.-Asiat., III, 374, 1811, Bering Sea; JORDAN & GILBERT, Synopsis, 314, 1883.

Represented southward by a form provisionally recorded as

### 779a. SALMO MYKISS CLARKII (Richardson).

(COLUMBIA RIVER TROUT.)

Not evidently different from the preceding. Usually profusely spotted, with the red cut-throat mark distinct. Scales small, in 150 to 164 cross-series. Back profusely spotted, anteriorly and posteriorly, the spots often extending on the belly. Coastwise streams from Puget Sound, south to Elk River, Humboldt County, California; locally abundant; replaced inland by var. *gibbsii* and var. *lewisi*. (Named for Capt. William Clark (1770–1838) of the famous expedition of Lewis and Clark.)

*Salmo clarkii*, RICHARDSON, Fauna Bor.-Amer., III, 225, 1836, Cathlapootl River. (Coll. Dr. Gairdner.)

*Fario stellatus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 219, Fort Steilacoom, Shoalwater Bay.

*Salmo brevicauda*, SUCKLEY, Ann. Lyc. Nat. Hist. N. Y., VII, 1861, 308, Puget Sound. (Coll. Kennerly, Cooper, and Suckley.)
*Salmo stellatus*, GÜNTHER, Cat., VI, 117, 1866.
*Salmo aurora*, GÜNTHER, Cat., VI, 119, 1866.
*Salmo brevicauda*, GÜNTHER, Cat., VI, 120, 1866.

Represented in the head waters of Snake River, Yellowstone River, and Missouri River by

### 779b. SALMO MYKISS LEWISI (Girard).

(YELLOWSTONE TROUT; CUT-THROAT TROUT.)

Similar to var. *clarkii* in all respects, the body perhaps a little more robust, with the spots encroaching less on the belly. Scales small, 145 to 170. Red throat mark always present. The Snake River Basin above the Shoshone Falls, and crossing the main divide of the Rocky Mountains at Two-Ocean Pass to the head waters of the Yellowstone, thence to other affluents of the Upper Missouri; common in all suitable waters. Infested in Yellowstone Lake by great numbers of a parasitic worm (*Dibothrium cordiceps**, Leidy). (Named for Captain Meriwether Lewis, (1774–1809), leader of the noted exploring expedition of Lewis & Clark, in 1803–6.)

*Salar lewisi*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 219, Falls of Missouri River. (Coll. Lewis & Clark.)
*Salmo carinatus*, COPE, Hayden's Geol. Surv. Mont., 1871 (1872), 471, locality unknown, probably Yellowstone River.

Represented in tributaries of the Columbia between Shoshone Falls and the Cascade Range by the variable and imperfectly defined

### 779c. SALMO MYKISS GIBBSII (Suckley).

Scales small, usually 142 to 175 series. No red below lower jaw; no hyoid teeth. To this form are provisionally referred the variously intermediate examples from the streams of Idaho and Washington, mentioned by Gilbert and Evermann in the paragraph quoted on page 489. Similar specimens have been since taken by Dr. Gilbert in the Des Chutes and other rivers, and by Dr. Evermann in Big Payette Lake, Idaho. It seems to be the prevailing form in the region between that occupied by *clarkii* near the coast, and that taken by *lewisi* above the Shoshone Falls. (Named for Dr. George Gibbs, geologist of the Northwest Boundary Commission.)

*Fario tsuppitch*, GIRARD, Proc. Ac. Nat. Sci. Phila., VIII, 1856, 218, Fort Dallas, Oregon; not of RICHARDSON.
*Salmo gibbsii*, SUCKLEY, Ann. Lyc. Nat. Hist N. Y., 1858, Fort Dallas; (Type, No. 940); also in Yakima River, John Day's River, and Boise River, and at The Dalles; SUCKLEY, Monogr. Salmo, 141, 1861 (1874).

Represented in western Nevada and neighboring parts of California by

### 779d. SALMO MYKISS HENSHAWI (Gill & Jordan).

(LAKE TAHOE TROUT; TRUCKEE TROUT; SILVER TROUT.)

Head $3\frac{4}{5}$; depth 4. D. 11; A. 12; scales 27–160–27 to 37–184–37; usually 170 in a longitudinal series; cœca 50–60. Body elongate, not greatly compressed. Head comparatively slender and long acuminate, its upper surface very slightly carinated; muzzle somewhat pointed, but bluntish at the tip; head not convex above; maxillary rather short, not reaching much beyond the eye. Vomerine teeth as usual; a small, rather narrow, but usually distinct patch on the hyoid bone. Dorsal fin small; caudal fin short, rather strongly forked. Scales medium. Coloration dark green in life, in the pure waters of Lake Tahoe; pale green in the salty waters of Pyramid Lake; the sides silvery, with a strong lateral shade of coppery red; back about equally spotted before and behind; the spots large and mostly round; sides with rather distant spots; belly generally with round spots; head with large black spots above, some even on the snout and on lower jaw; dorsal and caudal also spotted; a few spots on anal; red dashes on lower jaw; young specimens less spotted. Length 18 inches or more, usually weighing 5 or 6 pounds, but occasionally 20 to 29 pounds. Basin of the post-Tertiary Lake Lahontan; found in Lake Tahoe, Pyramid Lake, Webber Lake, Donner Lake, Independence Lake, Truckee River, Humboldt River, Carson River, and in most streams of the east slope of the Sierra Nevada; also in the head waters of Feather River, west of the Sierra Nevada, where it is probably introduced from Nevada. Related to *Salmo mykiss*, but better distinguished than most of the varieties, with a longer and more conical head, and with the spots differently arranged. A fine trout, now common in the San Francisco markets.

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*For a full discussion of this parasite and its relation to the trout of Yellowstone Lake see Linton "On Two Species of Larval Dibothria from Yellowstone National Park," in Bull. U. S. Fish Comm., IX, 1889, 65–79, plates 23–27.

In Lake Tahoe there are two forms of this type, (1) the ordinary Tahoe Trout (locally known to fishermen as "Pogy," the young as "Snipe"), weighing from 3 to 6 pounds, dark in color, with coppery sides, ascending the streams to spawn, and (2) the "Silver Trout," a large robust trout profusely spotted, the spots often oblong, the coloration more silvery. These trout live in deep water and spawn in the lake itself. A careful comparison of specimens convinces us that there is no specific nor varietal difference between the one and the other. The largest "Silver Trout" on record, weighing 29 pounds, was caught at Tahoe City, about 1876, and sent as a present to Gen. U. S. Grant. The following is a description of a Silver Trout taken near Tahoe City in September, 1894, and presented to the Leland Stanford Junior University by Mr. A. J. Bayley, of Tahoe City:

Specimen 2 feet 4 inches long, weighing $7\frac{1}{2}$ pounds. Head $4\frac{1}{15}$; depth $3\frac{4}{5}$; eye $7\frac{2}{3}$ in head. D. 9; A. 12; B. 10; scales 33–205–40 (140 pores). Pectoral $1\frac{2}{3}$ in head. Maxillary $1\frac{2}{3}$.

Body very robust, compressed, unusually deep for a trout, the outline elliptical. Head large, rather more compressed than in typical *Salmo henshawi*, (possibly a character of the adult male). Eye small, silvery. Vomerine teeth in two long series, those of the two series alternating in position. Hyoid teeth distinct, in a rather long series. Gill rakers short, thickish, 5+13. Mouth large, the maxillary extending well beyond the eye. Preopercle moderate, its lower posterior edge not evenly rounded, but with a slightly projecting, rounded lobe and a slight concavity above and below; this character not strongly marked. Opercle evenly, but not strongly, rounded. Scales small, reduced above and below, those in or near lateral line largest. Fins moderate, the anal rather high, with one more ray than usual. Caudal slightly lunate, almost truncate when spread open. Color dark-green above, belly silvery; sides with a broad coppery shade covering cheeks and opercles; sides of lower jaw yellowish; fins olivaceous, a little reddish below. Orange dashes between rami of lower jaw moderately conspicuous. Back, from tip of snout to tail, closely covered with large, unequal black spots. Spots on top of head and nape round; posteriorly the spots run together, forming variously shaped markings, usually vertically oblong; these may be regarded as formed of three or four spots placed in a series, or with one or two at the side of the other; the longest of the oblong markings are not quite as long as eye. Along side of head and body the spots are very sparse, those on head round, those behind vertically oblong. Belly profusely covered with small black spots, which are nearly round; still smaller round spots numerous on lower jaw; all the spots on caudal peduncle vertically oblong or curved. Dorsal and caudal densely covered with oblong spots, smaller than those on the body. Anal with rather numerous round spots; pectorals and ventrals with a few small spots, the first ray in each case with a series of faint small spots; adipose fin spotted.

(Named for Henry W. Henshaw, naturalist of the Geological Survey west of the 100th meridian, who discovered the species.)

*Salmo henshawi*, GILL & JORDAN, Man. Vert., Ed. 2, 358, 1878, Lake Tahoe; JORDAN & HENSHAW, Rept. Chief Eng., Part 3, 1878, App. NN, 1619, plate IV; JORDAN, Proc. U. S. Nat. Mus., I, 1878, 75; JORDAN & GILBERT, Synopsis, 316, 1883.

*Salmo tsuppitch*, JORDAN & HENSHAW, Rept. Chief Engineers, Part 3, 1878, App. NN., 1618; not of RICHARDSON.

Represented in the lakes and streams of the Great Basin (Lake Bonneville) by

### 779e. SALMO MYKISS VIRGINALIS (Girard).

(TROUT OF UTAH LAKE.)

Profusely but rather finely spotted, the spots being numerous anteriorly as well as posteriorly, confined to the back rather than to the tail. Scales a little larger than in other forms, 140 to 150 in lengthwise series, anteriorly less crowded than in *spilurus* and *stomias*. In partially alkaline or milky waters, as in Utah Lake, this form reaches a large size—8 to 12 pounds—and is very pale in color, the dark spots few and small, mostly confined to the back. Similar variations are shown by the other forms of trout in other lakes. Lakes and streams west of the Wahsatch range, especially in Bear, Provo, Jordan, and Sevier rivers, and in Utah Lake; locally very abundant and of importance as a food-fish. (*virginalis*, like a virgin.)

*Salar virginalis*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 220, Utah Lake.

*Salmo utah*, SUCKLEY, Monogr. Salmo, 136, 1861 (1874), Utah Lake; pale specimens from the lake.

*Salmo mykiss virginalis*, JORDAN, Bull. U. S. Fish Comm., IX, 1889, 14, pl. 3, fig. 9.

Represented in the Rio Grande Basin by

### 779f. SALMO MYKISS SPILURUS (Cope).

(RIO GRANDE TROUT.)

Head 3½; depth 4. D. 11; A. 10; scales 37-160-37. Head heavy, but proportionately short, its upper surface considerably decurved; interorbital space transversely convex, obtusely carinated; the head more convex than in any other of our species. Mouth large, maxillary reaching past eye. Teeth on vomer in two distinct series. Dorsal fin low in front, high behind, the last ray more than ⅔ the height of the first; last ray of the anal rather long; caudal with its middle rays about as long as the others. Profusely spotted; back and sides with round black spots, the spots most developed posteriorly, few on the head, most numerous on the caudal and adipose fin; sides with pale blotches. Length 30 inches. Upper Rio Grande and southward into the mountains of Chihuahua; abundant in mountain streams. In all respects apparently identical with subspecies *pleuriticus*, except that the scales are less crowded anteriorly and the number in a longitudinal series is 155 to 160. (*σπίλος*, spot; *οὐρά*, tail.)

*Salmo spilurus*, COPE, Hayden's Geol. Surv. Mont., 1871 (1872), 470, Sangre de Cristo Pass, Colorado.

*Salmo mykiss spilurus*, JORDAN, Bull. U. S. Fish Comm., IX, 1889, 14, pl. 3, figs. 7 and 8.

Represented in the Colorado River Basin by

### 779g. SALMO MYKISS PLEURITICUS (Cope).

(COLORADO RIVER TROUT.)

Opercle short, 4⅗ to 5 in head. Scales small, 185 to 190. Close to the typical *mykiss*, but the black spots chiefly gathered on the posterior part of the body, the head nearly immaculate; extremely variable, the lower fins usually red, but sometimes orange; usually a red lateral band. Basin of the Colorado. A large, handsome, and variable trout, sometimes profusely speckled, sometimes with large spots, and occasionally with strong golden shades. Abundant throughout western Colorado and in all clear mountain streams throughout Arizona; specimens from the Colorado Chiquito similar to those from the Eagle and the Gunnison, in Colorado. (*pleuriticus*, from *πλευρόν*, side, in allusion to the red lateral band.)

*Salmo pleuriticus*, COPE, Hayden's Geol. Surv. Mont., 1871 (1872), 471, head waters of Green River, Wyoming.

*Salmo mykiss pleuriticus*, JORDAN, Bull. U. S. Fish Comm., IX, 1889, 14, pl. 2, fig. 6.

Represented in Waha Lake by

### 779h. SALMO MYKISS BOUVIERI (Bendire).

(WAHA LAKE TROUT.)

Head 4; depth 4⅔; eye 4. D. 10; A. 11; B. 12; scales 175. Maxillary 2⅕ in head. Size small. Similar to *S. mykiss*, but with dark spots only on the dorsal, caudal, and adipose fin, and on the tail behind front of anal, where the spots are very profuse, smaller than pupil. Anterior regions dusky-bluish, not silvery; red blotch on inner edges of dentary bones below very conspicuous. Head shorter and deeper than in *mykiss*, the snout shorter and blunter, not longer than eye. Opercle and preopercle less convex than in *mykiss*. Caudal moderately forked. A singularly colored local variety, found in Waha Lake, Washington, a mountain lake without outlet. (Named for Captain Bouvier.)

*Salmo purpuratus bouvieri*, BENDIRE, in JORDAN & GILBERT, Synopsis, 315, 1883, Waha Lake, Washington. (Coll. Capt. Charles Bendire, U. S. A.)

*Salmo mykiss bouvieri*, JORDAN, Bull. U. S. Fish Comm., IX, 1889, pl. 4, fig. 10.

Represented in the Upper Arkansas and South Platte rivers by

### 779i. SALMO MYKISS STOMIAS (Cope).

(Green-back Trout.)

Mouth small; scales small, about 180. A small black-spotted trout, rarely reaching a pound in weight, close to var. *mykiss*, differing mainly in the very large size of its black spots, which are mainly gathered on the posterior half of the body. Back deep green, sides sometimes red. Flesh deep red. Head waters of Arkansas and South Platte rivers, in brooks and shallow places in lakes; abundant. (στομίας, big-mouthed.)

*Salmo stomias*, Cope, Hayden's Geol. Surv. Wyom. for 1870 (1871), 433, South Platte River, locality unknown. (Coll. Dr. Hammond.)

*Salmo mykiss stomias*, Jordan, Bull. U. S. Fish. Comm., ix, 1889, 15, pl. 1, fig. 2.

Represented in the lakes in eastern Colorado by

### 779j. SALMO MYKISS MACDONALDI, Jordan & Evermann.

(Yellow-fin Trout.)

Head 4; depth 4½ to 5; eye 5½; snout 4½. D. 12; A. 11; B. 10; scales 40–184–37, 125 pores. Head long, compressed, the snout moderately pointed; mouth rather large, the maxillary 1⅘ to 2 in head; hyoid teeth present; opercle long, 4½ in head, its margin strongly convex. Allied to subspecies *pleuriticus*, but with the head and opercles longer and the color different. Body elongated, compressed. Gill rakers 10 + 10. Scales small, regularly placed. Color light olive; a broad shade of lemon-yellow along sides; lower fins bright yellow; no red anywhere except the "cut-throat" dash characteristic of *Salmo mykiss*. Body posteriorly, and dorsal and caudal fin profusely speckled with small pepper-like dots, smaller than the nostril; on head and anterior parts few or none of these spots are present. Flesh pale. A very handsome trout, abundant on gravelly bottoms in Twin Lakes,* tributary to the Arkansas River in the Saguache Range near Leadville, Colorado; not found in brooks. It reaches a weight of nearly 9 pounds. It is probably descended from the form called *pleuriticus*, certainly not from its associate *stomias*, with which it has very little in common. (Named for Col. Marshall McDonald, United States Fish Commissioner.)

*Salmo mykiss macdonaldi*, Jordan & Evermann, Proc. U. S. Nat. Mus., 1889 (January 20, 1890), 453, Twin Lakes, Colorado; (Type, No. 41730. Coll. Geo. R. Fisher); Jordan, Bull. U. S. Fish Comm., ix, 1889, 11, pl. 1, fig. 1.

### 780. SALMO GAIRDNERI, Richardson.

(Steelhead; Hardhead; "Salmon Trout.")

We retain the name *Salmo gairdneri* for the large sea trout of the Pacific Coast and their derivatives; forms typically with moderate or small scales, and without the strongly-marked red dashes at the throat

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*This form of trout occurs in company with subspecies *stomias*, but in Twin Lakes, the two are entirely distinct, the habits, size, and coloration being notably different. If we were to consider the Arkansas Basin alone, the two must be ranked as distinct species, but these and all other American trout seem to be connected by intergradations. Apparently *macdonaldi* is derived from the Colorado River *pleuriticus*, which may be descended from *spilurus*, the latter in turn from *stomias*. *Stomias*, *virginalis*, *henshawi*, and *bouvieri* seem to have sprung directly from *mykiss*.

which mark the Cut-throat series of trout, or *Salmo mykiss*. These forms are usually well separated from *mykiss*, on the one hand, and from *irideus* on the other. There is, however, a strange medley of forms apparently aberrant or intermediate, confusing any attempt at specific definition.

The following analytical key contrasts the two most clearly marked varieties:

*a.* Scales rather small, averaging 155 cross series, the number varying from 130 to 180 (counting the oblique cross series above lateral line). Sea-running forms reaching a large size; weight of sea-run adult 8 to 20 pounds; landlocked forms much smaller, down to ½ pound. Coloration pale, with few spots. Columbia River and southward to San Francisco Bay. GAIRDNERI, 780.

*aa.* Scales larger, averaging about 135 cross series, the number varying from 130 to 145. Lake forms; coloration very silvery and with few spots; weight 3 to 10 pounds. Fraser River, etc. KAMLOOPS, 780a.

Represented in large rivers and estuaries, especially from the Columbia southward to Monterey, by the anadromous form, the typical

### 780. SALMO GAIRDNERI, Richardson.

(STEELHEAD; HARDHEAD; SALMON TROUT.)

B. 12 or 11; D. 11; A. 12; scales usually about 150–28, varying in specimens from Astoria from 137 to 177 (specimens counted by Cramer and Otaki); pyloric cœca 42; vertebræ 38 + 20. Body rather stout, not very deep mesially, but with the caudal peduncle thick. Head comparatively short and rather slender, in the females small, in the males the jaws more or less prolonged; maxillary rather narrow, the small eye nearly above its middle; lower jaw included; upper jaw in males emarginate at tip and at junction of premaxillary. Teeth rather small, those on the vomer in two long, alternating series, which are about as long as the palatine series. Preopercle rather wide, with the lower limb short; opercle moderate. Gill rakers short and thick, 8 + 12 (essentially as in our other species). Ventral appendage not half the length of the fin. Tail wide, squarely truncate in the adult, somewhat emarginate in the young. Flesh rather pale. Bones much firmer than in *Oncorhynchus*. Color olive green above; sides silvery; head, back, upper fins, and tail more or less densely covered with black spots; belly usually unspotted; males with colors heightened, the back greenish; both sexes in spring with a broad flesh-colored lateral band, deep rosy red on the opercles, this often retained throughout the year; fins not red; no red on the membrane of lower jaw. Length 30 inches. Coastwise streams from Santa Ynez Mountains, Santa Barbara County, California, northward to British Columbia, west of the Sierra Nevada and Cascade Range, especially abundant in the Lower Columbia, ascending the Snake River as far as Auger Falls. Also common in Russian River and Klamath River. A large trout, abounding in the mouths of the rivers, reaching a weight of 20 pounds or more, migratory like the salmon, and ascending rivers fully as far. It spawns later than the salmon, (in early spring in the Snake and Salmon rivers in Idado), and is found in the lower parts of the rivers, spent, at the time of the spring salmon run. It is then nearly useless as food, but at other times it is similar in quality to other trout. In streams where it is resident, it rarely exceeds 5 or 6 pounds. Resident forms seem to pass into "*irideus*" southward and should be carefully compared with the latter; northward into "*kamloops*," while in the Lower Snake River it seems to intergrade with *mykiss*, through the form called *gibbsii*. In the Lower Columbia, according to Dr. Gilbert, it is well separated from *mykiss* on the one hand and from the non-migratory *S. irideus masoni* on the other. Both young and old are there well separated from *irideus*. (Named for Dr. Gairdner, its discoverer, an employee of the Hudson Bay Company at Fort Vancouver, mentioned by Richardson as an able and promising young naturalist.)

*Salmo gairdneri*, RICHARDSON, Fauna Bor.-Amer., III, 221, 1836, Columbia River at Fort Vancouver; SUCKLEY, Monogr. Salmo, 114, 1861 (1874); GÜNTHER, Cat., VI, 118, 1866.

*Salmo truncatus*, SUCKLEY, Ann. Lyc. Nat. Hist. N. Y., 3, 1858, New Dungeness, Straits of Fuca; GÜNTHER, Cat., VI, 122, 1866.

*Fario aurora*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 218; GIRARD, Pac. R. R. Surv., X, 308, pl. 68, 1858, Astoria, Oregon. (Coll. Trowbridge.)

*Fario newberryi*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1858, 224, Klamath River; specimen with scales, 36–146–33.

*Fario gairdneri*, GIRARD, Pac. R. R. Surv., X, 313, 1858.

*Salmo purpuratus*, GÜNTHER, Cat., VI, 116, 1866.

Represented in the lakes of British Columbia and northern Washington by

### 780a. SALMO GAIRDNERI KAMLOOPS (Jordan).

(KAMLOOPS TROUT; STIT-TSE.)

Head 4½; depth 4⅓; eye 4½. D. 11; A. 11 or 12; scales 30–135 to 146–26, 65 scales before the dorsal. Body elongate, somewhat compressed, the maxillary extending beyond the eye, its length not quite half the head; snout slightly rounded in profile, the profile regularly ascending; eye large, about as long as snout; teeth moderate, some of those in the outer row in each jaw moderately enlarged; opercles striate, not much produced backward; branchiostegal rays 11 on each side; dorsal fin rather low, its longest ray slightly greater than the base of the fin, 1⅗ in head; anal fin rather larger than usual in trout, its outline slightly concave, its longest ray greater than the base of the fin and a little more than half head; adipose fin moderate; caudal fin rather broad, distinctly forked, its outer rays about twice inner; pectoral fins rather long, 1⅓ in head; ventrals moderate, 1¾ in head; gill rakers comparatively short and few in number, about 6 + 12 or 11. Coloration dark olive above, bright silvery below, the silvery color extending some distance below the lateral line where it ends abruptly; when fresh, the middle of the sides in both specimens was occupied by a broad band of bright light-rose pink, covering about one-third of the total depth of the fish; back above with small black spots about the size of pin heads irregularly scattered and somewhat more numerous posteriorly; a very few faint spots on upper part of head; dorsal and caudal fins rather closely covered with small black spots similar to those on back but more distinct; a few spots on the adipose fin, which is edged with blackish; lower fins plain; the upper border of the pectoral dusky; a vague dusky blotch on the upper middle rays of the anal; ventrals entirely plain. Length of type 16¼ inches. Kamloops Lake, Okanogan Lake, Kootenay Lake, and other lakes tributary to Fraser River or to the Upper Columbia; locally abundant; a fine large trout, slender and graceful, somewhat different in appearance from the ordinary "Steelhead," but not distinguished by any technical character of any importance, and doubtless intergrading fully with the latter.

*Salmo kamloops*, JORDAN, Proc. U. S. Nat. Mus., 1892, Kamloops Lake, British Columbia. (Type, No. 44238. Coll. A. C. Bassett.)

### 781. SALMO IRIDEUS, Gibbons.

(RAINBOW TROUT; COAST RANGE TROUT.)

Head 4; depth 3⅘; eye 5. D. 11; A. 10; scales 21–135–20, varying considerably. Body comparatively short and deep, compressed, much more elongate in males than in females. Head short, convex, obtusely ridged above. Mouth smaller than in other species, the rather broad maxillary scarcely reaching beyond eye, except in old males. Eye larger than in other species. Vomerine teeth in two irregular series. Dorsal fin moderate; caudal fin distinctly, though not strongly forked. Color bluish above, the sides silvery; usually everywhere above profusely but irregularly spotted, the spots extending on the sides and on the vertical fins; spots on caudal small; belly nearly plain; sea-run specimens nearly plain silvery; with red lateral band and blotches. Weight ½ to 6 pounds. Mountain streams of the Pacific Coast; the typical form found in the brooks of the Coast Range in California, from the Klamath River to the San Luis Rey. Abundant and variable, probably entering the sea, and perhaps growing larger there, becoming a "Salmon Trout."

This form differs from *Salmo gairdneri* chiefly in the larger scales. Other characters are its small size and brighter colors; both sexes with a red lateral band. It is subject to large local variations, some of these landlocked in peculiar brooks, (*e. g.*, Purisima Creek in San Mateo County, California, where the individuals are small and brightly colored, popularly regarded as distinct species). Its range extends from the coast of Washington southward to San Diego County, California (Rio San Luis Rey). It is thought by some anglers that the young fishes hatched in the brooks from spawn of *gairdneri* remain in mountain streams for from six months to three years, going down to the sea with the high waters of spring, after which they return to spawn as typical *gairdneri*. Those which are landlocked or do not descend remain *irideus* all their lives. As against this view we have the fact that to the northward *irideus* and *gairdneri* are always distinguishable and the scales in *gairdneri* are always smaller than in typical rainbow trout. (*irideus*, rainbow-like.)

*Salmo irideus*, GIBBONS, Proc. Cal. Ac. Nat. Sci., 1855, 36, San Leandro Creek, Alameda County, California; JORDAN & GILBERT, Synopsis, 312, in part, 1883.

*Salmo rivularis*, AYRES, Proc. Cal. Ac. Nat. Sci., 1855, 43, Martinez, California.

The following analytical key will assist in the identification of the varieties of *Salmo irideus*, which we are at present disposed to recognize:

- *a.* Scales well imbricated; upper ray of pectoral usually more or less spotted.
  - *b.* Scales comparatively large, in 120 to 150 series; sides profusely spotted, both anteriorly and posteriorly, especially above the reddish lateral band.
    - *c.* Scales decidedly large, in 120 to 130 series. Body elongate; no red under the throat; eye large; anal rays 11 or 12. Brook forms mostly of small size; sea-run examples occasionally large; confined to the streams of the Coast Range.
      - *d.* Mouth moderate; coastwise streams of California. IRIDEUS, 781.
      - *dd.* Mouth very small; coastwise streams of Oregon and Washington. MASONI, 781a.
    - *cc.* Scales medium, in about 140 series. Body rather deep; eye comparatively small; anal rays 10 or 11. Coloration dark, usually with many spots; a small dash of red usually present at the throat. Size medium, weight 2 to 8 pounds. Streams of Upper Sacramento Basin, not running down to the sea. SHASTA, 781b.
  - *bb.* Scales small, in 150 to 185 series; size large.
    - *e.* Back profusely spotted, anteriorly as well as posteriorly; some red under lower jaw. Kern River, California. GILBERTI, 781c.
    - *ee.* Back with the spots chiefly posteriorly; no red under the lower jaw. Upper Sacramento Basin. STONEI, 781d.
- *aa.* Scales very small and not well imbricated, in about 175 transverse series. Belly, lower fins, and lateral band yellow; ventrals edged with pale; upper ray of pectoral unspotted; black spots numerous. A small form found in the head waters of Kern River. AGUA-BONITA, 781e.

### 781a. SALMO IRIDEUS MASONI (Suckley).

(BROOK TROUT OF WESTERN OREGON.)

The common brook trout of the tributaries of the lower Columbia and of coastwise streams of Oregon and Washington is very similar to the typical *irideus* and is readily distinguished from its associates, *gairdneri* and *mykiss*, by its large scales. Compared with *mykiss*, it is less slender, the snout more rounded; there is no red between branches of lower jaw; there are no hyoid teeth, the maxillary is broader and shorter, the opercle more evenly convex, and there are fewer spots below the lateral line; the red markings on sides usually coalesce into a red band. Scales 120–20 to 130–22. Size small, rarely weighing a pound. Puget Sound to southern Oregon, in streams of the Coast Range; locally abundant. Apparently merging into the ordinary *irideus* southward, if indeed the two forms are distinguishable. We know of no diagnostic character, but further comparison is needed. ("Named in honor of my good friend Governor Charles H. Mason of Washington Territory, who has so frequently aided me in adding to my collections specimens of great interest and value in various branches of natural history."—*Suckley*.)

*Fario clarkii*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 219; not of RICHARDSON.

*Salmo masoni*, SUCKLEY, Pac. R. R. Surv., XII, part 2, 345, 1860, Cathlapootl River. (Coll. Capt. Geo. B. McClellan.*)

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*"I obtained this species at the Cathlapootl River, Aug. 2, 1853, and am indebted for it to the skill of Capt. Geo. B. McClellan, as he took it with the artificial fly at a time when they did not readily bite at any bait."—*Suckley*.

Represented in the upper Sacramento and its tributaries, and probably in most of the eastern tributaries of the Sacramento and San Joaquin, by

### 781b. SALMO IRIDEUS SHASTA (Jordan).

(McCloud River Rainbow Trout.)

Head 4; depth 3⅘; D. 11; A. 11; scales 20 to 24–145–20, 65 before dorsal. Body comparatively short and deep, compressed, varying considerably, and much more elongate in the males than in the females. Head short, convex, obtusely ridged above. Mouth smaller than in most other forms of the genus, the rather broad maxillary scarcely reaching beyond eye except in old males; maxillary 1¾ in head in males, 2 in females. Eye larger than in typical *gairdneri*, 5 in head. Vomerine teeth in two irregular series. Dorsal fin moderate; caudal fin distinctly though not strongly forked, more deeply incised than in typical *mykiss*; pectoral 1⅛ to 1¾ in head. Scales comparatively large. Coloration bluish above, the sides silvery; everywhere above profusely but irregularly spotted, the spots extending on the sides and on the vertical fins; head well spotted; dorsal, caudal, and usually upper ray of pectoral spotted; spots on caudal small; belly nearly plain; fins usually not red; almost always a dash of red between branches of lower jaw; males and usually females also with red lateral band and blotches; much red on cheeks and opercles; belly partly red in males. Length 10 to 30 inches. Weight 2 to 8 pounds. Streams of the Sierra Nevada, from Mount Shasta southward, best known from McCloud River; the limits of its range not well known; abundant, and subject to many variations; also introduced into Truckee River and into many eastern streams, this form being the usual "Rainbow Trout" of fish-culturists. (Named for Mount Shasta.)

*Salmo irideus*, or Rainbow Trout of most writers and especially of fish-culturists; not *Salmo irideus*, Gibbons, which is based on coastwise specimens.

*Salmo gairdneri shasta*, Jordan, Thirteenth Biennial Rept. Fish Comm. California, 1894, 142, with plate, McCloud River, at Baird, Shasta County, California. (Type, No. 903, L. S. Jr. Univ. Mus. Coll. Stone.)

Represented in the lower waters of Kern River on the west slope of the Sierra Nevada by

### 781c. SALMO IRIDEUS GILBERTI (Jordan).

(Kern River Trout.)

Entirely similar to the McCloud River Trout, except that the scales are smaller, as small as in typical *mykiss*, in about 165 transverse series. The body is robust, the mouth moderate; back and sides profusely spotted; old specimens with more or less orange between the branches of the lower jaw, this mark faint or wanting in the young. Upper ray of pectoral spotted. Kern River, California, abundant in the river channels, below the waters inhabited by subspecies *agua-bonita*. Large, reaching a weight of 8 pounds. Our specimens from south fork of Kern River, at Soda Springs, California. (Named for its discoverer, Dr. Charles Henry Gilbert.)

*Salmo gairdneri gilberti*, Jordan, Thirteenth Biennial Rept. Fish Comm. California, 1894, 143, with plate, South Fork of Kern River at Soda Springs, California. (Type, No. 1511, L. S. Jr. Univ. Mus. Coll. Gilbert.)

In the Sacramento River is occasionally taken

### 781d. SALMO IRIDEUS STONEI (Jordan).

(NISSUEE TROUT; NO-SHEE TROUT.)

Anal rays 11. Depth 4 in length. Pectoral 1⅓ in head. Eye large, 4½ in head. Maxillary 2⅒. Distinguished by its small scales, the number of scales in a longitudinal series being about 155, 82 before dorsal, where they are small and embedded, 25 above lateral line. Teeth fewer and smaller than in var. *shasta*, those on the vomer in a single zigzag series. Axillary scale of ventral small. Upper parts plain greenish; spots few, and confined chiefly to posterior part of body; spots small and sparse on dorsal, adipose fin, and caudal; a red lateral band usually distinct; cheeks and opercles with red; no red between branches of lower jaw. Described from a specimen 14 inches in length, collected by Livingston Stone in McCloud River at Baird, California. This form is well known to Indians and to fishermen on the Upper Sacramento. According to Mr. Stone, the Indian fishermen say that it is abundant in the McCloud River, about 8 miles above Baird. They are larger in size than the ordinary *irideus*, one having been taken weighing 12 pounds. A second specimen is deeper in color, the red lateral band very distinct (female taken in May). The scales rather larger (140) and irregularly placed. (Named for its discoverer, Livingston Stone, Superintendent of the United States Fish Hatchery at Baird, in recognition of his valuable services in the propagation of salmon and trout.)

*Salmo gairdneri stonei*, JORDAN, Thirteenth Biennial Rept. Cal. Fish Comm., 1894, 142, with plate, McCloud River at Baird, California. (Type, No. 900, L. S. Jr. Univ. Mus. Coll. Stone.)

Represented in the mountain streams of the Sierra Nevada, on the west slope of Mount Whitney, by

### 781e. SALMO IRIDEUS AGUA-BONITA (Jordan).

(GOLDEN TROUT OF MOUNT WHITNEY.)

Head 3¾; depth 4⅓. D. 12; A. 10; scales in 160 to 180 rows, 123 pores. Body formed as usual. Head rather long, bluntish at tip; mouth moderate, the maxillary extending a little beyond the eye, 1⅘ in head; hyoid teeth not evident; opercle moderate; postorbital bone very small, its greatest length 4⅓ in head; its posterior margin moderately convex; eye 4⅔ in head; snout 4½; gill rakers not very short, 10 + 11. Scales extremely small, round, not imbricated, smaller than in other forms of *Salmo*. Fins moderate; the anal high; the caudal moderately emarginate; pectoral $1\frac{4}{7}$ in head; ventral 2; caudal 1⅖. Olive above; sides and belly light golden, always showing the dark cross shades of immature trout; middle of sides along lateral line with a deep scarlet lateral stripe, broadest under the dorsal, where it is about as wide as eye, thence narrowing to either end and not reaching either head or caudal; middle line of belly with a broad scarlet band, extending from chin to anal fin, equally bright all the way; a fainter shade along lower side from anal fin to tip of caudal; no crimson dash at throat between branches of lower jaw; the whole region uniform bright orange; opercle largely orange; dark spots chiefly posterior, large and well marked, some as large as pupil on tail and posterior part of body; smaller and well marked on dorsal; a few small ones scattered along forward to the head in two specimens; none on body before adipose fin in the other; upper anterior angle of dorsal abruptly yellowish white; this color edged by a dark oblique streak made by coalescent spots; the rest of the fin light olive with 4 or 5 rows of small black spots; pectorals light orange; ventrals deep orange, with a faint blackish tip; the anterior edge of the fin conspicuously and abruptly whitish, as in *Salvelinus fontinalis*; anal dusky orange, the tips of the last rays blackish, the outer anterior corner abruptly white, the white stripe wider than the pupil and separated from the color of the fin by a dusky shade; caudal olive, tinged with orange on its lower edge, and profusely spotted with black; inside of mouth pink, of gill cavity light orange. The small size of the scales is shown in their lack of imbrication rather than by their increased number. Mountain streams on the west side of Mount Whitney, tributary to Kern River, locally abundant in Volcano Creek, and South Fork of Kern River; also largely introduced into streams about Owen Lake, on the east slope of the mountains, streams formerly destitute of trout. (Gilbert.) This form is apparently derived from the Kern river trout, var. *gilberti*, but is so much modified that unless intermediate specimens now exist, it may be ranked as a distinct species. ("*Agua-bonita*," beautiful water, name of a cascade on Volcano Creek, near which this trout abounds.)

*Salmo mykiss agua-bonita*, JORDAN, Proc. U. S. Nat. Mus., 1892, 481, Volcano or Whitney Creek,* California. (Types, No. 514, L. S. Jr. Univ. Mus. and 44237, U. S. Nat. Mus. Coll. Mr. Harvey of Lone Pine, Cal.)

## 236. CRISTIVOMER, Gill & Jordan.

(GREAT LAKE TROUT.)

*Cristivomer*, GILL & JORDAN, in JORDAN, Manual Vertebrates E. U. S., Ed. 2, 356, 1878, (*namaycush*).

This genus contains one or two species—large, coarse charrs, distinguished from *Salvelinus* by the presence of a raised crest behind the head of the vomer and free from its shaft; this crest is armed with teeth. The hyoid teeth constitute a strong, cardiform band. The typical species is a large charr or trout, spotted with gray instead of red, and found in the larger lakes of Eastern North America. (*crista*, crest; *vomer*, vomer.)

### 782. CRISTIVOMER NAMAYCUSH (Walbaum).

(GREAT LAKE TROUT; MACKINAW TROUT; LONGE (VERMONT); TOGUE (MAINE); NAMAYCUSH; MASAMACUSH.)

Head 4¼; depth 4; eye large, 4½. B. 11 or 12; D. 11; A. 11; lateral line 185 to 205. Body elongate, covered with thin skin, there being no special development of fatty tissue. Head very long, its upper surface flattened. Mouth very large, the maxillary extending much beyond the eye, the head and jaws proportionately lengthened and pointed. Maxillary nearly half the length of the head; interorbital space nearly one-fourth; teeth very strong. Caudal fin well forked; adipose fin small. General coloration dark gray, sometimes pale, sometimes almost black; everywhere with rounded paler spots, which are often reddish tinged; head usually vermiculate above; dorsal and caudal reticulate with darker. Length 36 inches. Reaches weight of 60 to 100 pounds, averaging about 17. Great Lake region and lakes of northern New York, New Hampshire, and Maine, the head waters of the Columbia and Fraser rivers, streams of Vancouver Island, and north to the Arctic Circle, said not to enter tidal waters; very abundant in the larger bodies of water; varying in form and color in the different lakes; specimens from Lac des Neiges, Canada, said to be almost black (Garman), others variously paler and gray. Some in smaller lakes short and deep in body. (An Indian name.)

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* It has since been ascertained that the original type came from Cottonwood Creek on the east slope of Mount Whitney, the variety having been introduced there from Volcano or Whitney Creek.

*Namaycush Salmon*, PENNANT, Arctic Zoölogy, Introd., 191, 1792, Hudson Bay.

*Salmo namaycush*, WALBAUM, Artedi Piscium, 68, 1792, Hudson Bay; based on the Namaycush Salmon of PENNANT; GÜNTHER, Cat., VI, 123, 1866, and of authors generally.

*Salmo pallidus*, RAFINESQUE, Amer. Monthly Mag., December, 1817, 120, Lake Champlain

*Salmo amethystinus*, MITCHILL, Journ. Ac. Nat. Sci. Phila., 1818, 410, Sault Ste. Marie.

*Salmo hoodii*, RICHARDSON, App. Ross's Voyage, LVIII, 1835, in part; specimen from Boothia Felix; RICHARDSON, Fauna Bor.-Amer., III, 174, 1836, Mingan River.

*Salmo confinis*, DE KAY, N. Y. Fauna: Fishes, 238, 1842, Louis Lake, Hamilton County, New York; Silver Lake, Pennsylvania.

*Salmo symmetricus*, PRESCOTT, Am. Journ. Sci. Arts, 1851, Vol. XI, 340, Lake Winnipiseogee, New Hampshire.

*Salmo toma*, HAMLIN, The Togue, in HOLMES, 2d Annual Report Maine Fish Comm., 1862, 109, Lakes of Maine.

*Salmo adirondacus*, NORRIS, American Angler's Book, 255, 1865, Adirondack Lakes.

*Salmo siscowet*, GÜNTHER, Cat., VI, 123, 1866; not of AGASSIZ.

*Salvelinus namaycush*, JORDAN & GILBERT, Synopsis, 317, 1883.

Represented in Lake Superior by

### 782a. CRISTIVOMER NAMAYCUSH SISCOWET (Agassiz).

(SISCOWET.)

Scales rather small, about 175 in the lateral line. Body short and deep, covered with thick skin, there being an excessive tendency to the development of fatty tissue. Head very short and deep, its upper surface broad and short, covered by a skin so thick as to completely hide the bones; no distinct median carina. Mouth very large, its gape narrower than in *C. namaycush*. Teeth weaker than in *C. namaycush*; supplemental bone also shorter and broader. Maxillary a little more than half the length of the head. Caudal fin well forked. Coloration as in *C. namaycush*, but usually paler; fin rays the same. Lake Superior; abundant, but not yet found elsewhere. Very close to the preceding, but differing in the shortness and breadth of the bones of the head and in the extreme fatness of the flesh. It is probably a local variety rather than a distinct species. (An Indian name, probably from the same root as *Cisco.*)

*Salmo siscowet*, AGASSIZ, Lake Superior, 333, 1850, Lake Superior.

*Salmo siskawitz*, AGASSIZ, in Herbert, Frank Forester's Fish and Fishing, 112, with plate, 1850, Lake Superior

*Salmo ursinus*, BARNSTON, Rept. Fisheries Canada, Lake Superior; reference uncertain.

*Salvelinus namaycush siscowet*, JORDAN & GILBERT, Synopsis, 318, 1883.

## 237. SALVELINUS (Nilsson) Richardson.

(CHARRS.)

*Salvelini*, NILSSON, Prodr. Ichth. Scand., 7, 1832, (*alpinus*); (group name).
*Salvelinus*, RICHARDSON, Fauna Bor.-Amer., III, 169, 1836, (*alpinus*); after NILSSON.
*Baione*, DE KAY, N. Y. Fauna: Fishes, 244, 1842, (*fontinalis*).
*Umbla*, RAPP, Fische Bodensee, 32, 1854, (*umbla = alpinus*).

Body moderately elongate. Mouth large or small. Teeth of jaws, palatines, and tongue essentially as in *Salmo*, the hyoid patch present or not. Vomer boat-shaped, the shaft much depressed, without raised crest, with teeth on the head of the bone and none on shaft. Scales very small, 200 to 250 in a lengthwise series. Fins moderate, the caudal forked in the young, truncate in some species in the adult. Sexual peculiarities not strongly marked, the males with the premaxillaries enlarged and a fleshy projection at the tip of the lower jaw. Coloration dark, with round, crimson spots, the lower fins sometimes with marginal bands of black, reddish, and pale. Species numerous in the clear streams and lakes of the northern parts of both continents, sometimes descending to the sea, where they lose their variegated colors and become nearly plain and silvery. The members of this genus are by far the most active and handsome of the trout, and live in the coldest, clearest, and most secluded waters. "No higher praise can be given to a Salmonoid than to say, it is a charr." (*Salvelinus*, an old name of the charr; from the same root as *Sälbling* or *Saibling*.)

*a*. Back unspotted, strongly marbled with dark olive or black; dorsal and caudal fins mottled; body rather stout, the head heavy; gill rakers small, 6 + 11, not curled. FONTINALIS, 783.
*aa*. Back not marbled with darker.
  *b*. Back with red spots, like those on the sides, but smaller and usually paler; mouth large, the maxillary reaching beyond eye; gill rakers 8 + 12. MALMA, 784.
  *bb*. Back unspotted, the red spots confined to the sides; maxillary usually not reaching beyond eye.
    *c*. Gill rakers numerous, 6 + 12 to 16; head rather large, 4 to 4½ in length; body rather stout; belly orange in breeding season. ALPINUS, 785.
    *cc*. Gill rakers fewer, 6 + 11, small; head small, 4¼ to 5 in length; body slender. OQUASSA, 786.

### 783. SALVELINUS FONTINALIS (Mitchill).

(BROOK TROUT; SPECKLED TROUT.)

Head 4½; depth 4½. D. 10; A. 9; scales 37–230–30; gill rakers about 6 + 11. Body oblong, moderately compressed, not much elevated. Head large, but not very long, the snout bluntish, the interorbital space rather broad. Mouth large, the maxillary reaching more or less beyond the eye. Eye large, usually somewhat above the line of the axis of the body. Caudal fin slightly lunate in the adult, forked in the young; adipose fin small; pectoral and ventral fins not especially elongate. Red spots on the sides rather smaller than the pupil; back mostly without spots, more or less barred or mottled with dark olive or black; dorsal and caudal fins mottled or barred with darker; lower fins dusky, with a pale, usually orange, band anteriorly, followed by a darker one; belly in the males often more or less red; sea-run individuals (the Canadian "Salmon Trout") are often nearly plain bright silvery. Many local varieties distinguished by shades of color, also occur. Length 18 inches or less. The best known of our charrs, abounding in all clear, cold streams from Maine to the Saskatchewan and northward to Labrador, southward in the Alleghanies to the head waters of the Savannah, Chattahoochee, Catawba, and French Broad; largely introduced into western streams but not native west of the Mississippi. (*fontinalis*, living in springs.)

*Salmo fontinalis*, MITCHILL, Trans. Lit. and Phil. Soc. N. Y., I, 1815, 435, near New York City;

*Salmo alleghaniensis*, RAFINESQUE, Ich. Oh., 44, 1820, Brooks falling into the Alleghany and Monongahela rivers.

*Salmo nigrescens*, RAFINESQUE, Ich. Oh., 45, 1820, near the Laurel Hills, Pennsylvania; GÜNTHER, Cat., VI, 152, 1866, and of nearly all early authors.

*Salmo canadensis*, HAMILTON SMITH, in Griffith's Cuvier, X, 474, 1834, Canada; dots blood red, each "in a white circular spot."

*Salmo hoodii*, RICHARDSON, Ross Voyage, App. LVIII, 1835, and Fauna Bor.-Amer., III, 173, 1836, Fort Enterprise, Pine Island Lake, etc.; based in part on *namaycush*.

*Salmo immaculatus*, * H. R. STORER, Bost. Journ. Nat. Hist., VI, 1850, 364, Lower St. Lawrence; (Canadian "Salmon Trout"), name preoccupied; GÜNTHER, Cat., VI, 125, 1866.

*Salmo hudsonicus*, SUCKLEY, Ann. Lyc. Nat. Hist. N. Y., 1861, 310, Hudson Bay and tributaries; Labrador; Newfoundland; (Coll. Drexler, Gill, and Coues); GÜNTHER, Cat., VI, 153, 1866.

*Salvelinus fontinalis*, JORDAN, Proc. U. S. Nat. Mus., 1878, 81, in part.

Represented in certain ponds in New Hampshire by

### 783a. SALVELINUS FONTINALIS AGASSIZII † (Garman).

(DUBLIN POND TROUT.)

Coloration pale grayish, almost without red spots, thus resembling the lake trout. Otherwise similar to *fontinalis*. (Named for Louis Agassiz.)

*Salmo agassizii*, GARMAN, Nineteenth Report Mass. Fish Comm., 1885, 20, Dublin Pond (Lake Monadnock), Keene, New Hampshire; Center Pond, New Hampshire.

### 784. SALVELINUS MALMA (Walbaum).

(DOLLY VARDEN TROUT; OREGON CHARR; BULL TROUT; RED-SPOTTED TROUT; MALMA; GOLET.)

Head 3⅔; depth 4; eye 4½. D. 11; A. 9; scales 39–240–36; pyloric cœca large, 45 to 50; gill rakers about 8 + 12. Body stout, the back somewhat elevated, deeper, and less compressed than in *S. fontinalis.* Head large, snout broad, flattened above. Mouth large, the maxillary reaching past the eye. Fins short; the caudal fin slightly forked or almost truncate; adipose fin usually large; in large specimens its length is twice that of the eye. General color olivaceous; the sides with round red spots nearly the size of the eye, the back commonly with smaller pale ones, a feature of coloration which distinguishes this species at once from the others; lower fins colored as in *S. fontinalis*, dusky, with a pale stripe in front, followed by a dark one; sea-run specimens silvery, with the spots faint or obsolete; fins and back without dark reticulations. Gill covers without concentric striæ. Length 5 to 20 inches. Streams east and west of the Cascade Range from the Upper Sacramento to Montana, Alaska, and Kamchatka, generally abundant northward, descending to the sea, where it reaches a weight of about 12 pounds. One of the most beautiful and active of all the *Salmonidæ.* In small mountain brooks, dwarf forms occur (as var. *lordii*, etc.), but it is not necessary to distinguish these by separate names. (*Malma*, a vernacular name in Kamchatka.)

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* Sea-run forms of this and other charrs and trout are larger in size, silver-gray in color and without spots, or nearly so. A silvery-gray form abundant in Canadian estuaries, and locally known as Salmon Trout, has been called var. *immaculatus*, but this name is preoccupied by *Salmo immaculatus*, Walbaum, which is one of the *Characinidæ*.

† This form is thus described by Mr. Garman:

*Salmo agassizii:* B. 11 to 13; D. 12 to 13; A. 10 to 12; V. 8 to 9; P. 14 to 15; pores 109 to 119; scales 38 to 42-217 to 237-38 to 42; second dorsal to lateral line, 28.

A variety of the brook trout; apparently restricted to the small lakes in the neighborhood of Dublin, New Hampshire. Compared with those of *S. fontinalis*, the young are rather more slender, the caudal notch slightly deeper, and the sides more silvery. The young are much darker colored than the adults; on both the red spots of the flanks are large and numerous. On the adult the brown color has become so much bleached that the specimen is nearly uniform silvery; very faint indications of the red spots remain. The differences between the young of *S. fontinalis* and those of this variety are even more marked than those between adults; side by side, the clouded parr marks or bands at once distinguish the young of *S. agassizii*. Apparently it is later in attaining sexual development, and has the appearance of a deep-water species. Length 7½ inches.

Snout longer than eye; maxillary extending behind orbit; in young the diameter of the eye equals the length of the snout, and the length of the head is one-fourth of the total, without caudal; the length of the head of a 12½-inch specimen (fig. 18) equals the depth of the body, and is contained 4¾ times in the length of the body and head. Dublin Pond; Lake Monadnock, Keene, New Hampshire; Center Pond.

*Goltra*, Krascheninnikow, Descr. Kamch., 183, 1768, Kamchatka.

*Malma*, Pennant, Arctic Zoöl., Introd., 126, 1792, Bering Sea; after Steller, etc.

*Salmo malma*, Walbaum, Artedi Piscium, 66, 1792, Kamchatka; based on *Malma*, of Pennant.

*Salmo curilus*, Pallas, Zoogr. Rosso-Asiat., III, 251, 1811, Curile Islands.

*Salmo callaris*, Pallas, Zoogr. Rosso-Asiat., III, 353, 1811, Bering Sea; Günther, Cat., VI, 143, 1866.

*Salmo penshinensis*, Pallas, Zoogr. Rosso-Asiat., III, 381, 1811, Gulf of Penshine; Worofskaja River.

*Salmo lævigatus*, Pallas, Zoogr. Rosso.-Asiat., III, 385, 1811, Curile Islands.

*Salmo nummifer*, Cuvier & Valenciennes, Hist. Nat. Poiss., XXI, 365, 1848, Kamchatka; on a drawing by Mertens.

*Salmo erythrorhynchos*, Cuvier & Valenciennes, Hist. Nat. Poiss., XXI, 367, 1848, Kamchatka.

*Salmo spectabilis*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 218, Fort Dalles, Oregon; name preoccupied.

*Salmo parkei*, Suckley, Ann. Lyc. Nat. Hist. N. Y., 1861, 309, Kootenay River. (Coll. Gibbs.)

*Salmo bairdii*, Suckley, Ann. Lyc. Nat. Hist. N. Y., 1861, 309, tributary of Flathead River, Montana. (Type, No. 2010. Coll. Kennerly.)

*Salmo campbelli*, Suckley, Ann. Lyc. Nat. Hist. N. Y., 1861, 313, Fort Dalles, Oregon; substitute for *spectabilis*; preoccupied. (Coll. Kennerly.)

*Salmo lordii*, Günther, Cat., VI, 148, 1866, Skagit River; dwarf specimens.

*Salmo tudes*, Cope, Proc. Amer. Phil. Soc. Phila., 1873, 24, Captains Harbor, Unalaska. (Coll. Prof. Geo. Davidson.)

*Salmo bairdii*, Günther, Cat., VI, 121, 1866.

*Salmo parkii* and *campbelli*, Günther, Cat., VI, 121, 149, 1866.

*Salvelinus spectabilis*, Jordan, Proc. U. S. Nat. Mus., I, 1878, 79.

*Salvelinus bairdii*, Jordan, Proc. U. S. Nat. Mus., I, 1878, 82.

*Salvelinus malma*, Jordan & Gilbert, Synopsis, 319, 1883; Evermann, Bull. U. S. Fish Comm., XI, 1891, 50, pl. XXV, fig. 1.

### 785. SALVELINUS ALPINUS (Linnæus).

(European Charr; Sälbling; Saibling; Ombre Chevalier; Greenland Charr.)

Head 4½; depth 5. D. 13; A. 12; scales 195 to 200. Vertebræ 59 to 62. Cœca 36 to 48. Body elongate, compressed; head moderate; maxillary extending little beyond orbit; hyoid teeth usually present, in a feeble band; teeth moderate. Grayish or greenish above, the lower parts red, especially in the male; lower fins anteriorly margined with white. Sides of body with round red spots; back not marbled. Gill rakers 6 + 11 to 18, usually longer than in *fontinalis*, and in the adult more or less curled. Cold lakes and mountain streams of central and northern Europe and northeastern America, abundant in suitable waters and running into many varieties. Some of the nominal species in Siberia may belong to this type, but too little is known of them to permit their reference, either to *Salvelinus alpinus* or to *Salvelinus malma*. (Eu.) (*alpinus*, alpine.)

*Salmo alpinus*, LINNÆUS, Syst. Nat., Ed. x, 1758, 309, Lapland, West Gothland, etc.
*Salmo salvelinus*, LINNÆUS, Syst. Nat., Ed. x, 1758, 309, Lintz in Austria.
*Salmo salmarinus*, LINNÆUS, Syst. Nat., Ed. x, 1758, 310, "Tridenti in fluviis frigidus saxosis."
*Salmo umbla*, LINNÆUS, Syst. Nat., Ed. x, 1758, 310, Lakes of Switzerland and Italy.
*Salmo ventricosus*, NILSSON, Prodromus, 7, 1832, Western Norway.
*Salmo rutilus*, NILSSON, Prodromus, 10, 1832, Hadeland, Norway.
*Salmo ascanii*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XXI, 256, 1848, Norway.
*Salmo distichus*, HECKEL, Reisebericht, 93, 1851, Austria.
*Salmo monestichus*, HECKEL, Reisebericht, 93, 1851, Austria.
*Salmo rivalis*, GAIMARD, Voyage Island, Grœnland, pl. 15, 1851, Iceland.
*Salmo alpinus nivalis*, FABER, Fische Islands, 169, Iceland.
*Salmo willughbii*, GÜNTHER, Proc. Zoöl. Soc., 1862, 46, Lake Windermere.
*Salmo grayi*, GÜNTHER, Proc. Zoöl. Soc., 1862, 51, Lough Melvin, Ireland.
*Salmo colii*, GÜNTHER, Proc. Zoöl. Soc., 1863, 12, Lough Esk.
*Salmo perisii*, GÜNTHER, Ann. Mag. Nat. Hist., XV, 1865, 75, North Wales.
*Salmo killinensis*, GÜNTHER, Proc. Zoöl., 1865, 699, Loch Killin, Inverness.
*Salmo carbonarius*, STRÖM, Egers Beskrivelse, 122, Western Norway.

Represented in American waters by several forms, scarcely differentiated from each other or from the parent type. We provisionally recognize the following, but do not know any positive character by which to separate any of them from *Salvelinus alpinus*.

Represented in the inlets of Boothia by the long-finned

### 785a. SALVELINUS ALPINUS ALIPES (Richardson).

(LONG-FINNED CHARR.)

D. 11; A. 10; scales 210; B. 11; cœca 41. Body elongate; head of moderate size; snout elongate, pointed, with the lower jaw projecting beyond the upper in adult examples. Teeth small. Maxillary elongate, narrow, extending beyond the eye. Preopercle very short, with a very short lower limb; opercle and preopercle very conspicuously and deeply striated, the striæ radiating from the base of each. Fins much developed, the dorsal much higher than long; pectoral very long, reaching more than halfway to ventrals, which are also very long; adipose fin very small; caudal well forked. Lakes of Greenland and Boothia Felix. (Günther.) (*ala*, wing; *pes*, foot).

*Salmo alipes*, RICHARDSON, Nat. Hist. App. Ross's Voy., LVII, 1835, and Fauna Bor.-Amer., III, 169, 1836, lakes in Regent's Inlet, Boothia Felix; GÜNTHER, Cat., VI, 149, 1866.
*Salmo nitidus*, RICHARDSON, App. Ross's Voy., LVII, 1835, Lake at Regent's Inlet, Boothia Felix; and Fauna Bor.-Amer., III, 171, 1836; GÜNTHER, Cat., VI, 150, 1866. In *nitidus*, the dorsal and pectoral are represented as a little shorter than in *alipes*, but no other evident difference.
*Salvelinus nitidus*, JORDAN & GILBERT, Synopsis, 321, 1883.
*Salvelinus stagnalis*, JORDAN & GILBERT, 321, 1883.

Associated with *S. alipes* and probably not distinct from it, and like it not entering the sea is

### 785b. SALVELINUS ALPINUS STAGNALIS (Fabricius).

(GREENLAND CHARR.)

Gill rakers as in *alpinus*, slender and straightish, 9 + 15 in number, the longest 2⅓ in eye. Body moderately elongate; pectorals shortish, 1⅔ in head, not reaching quite halfway to ventral; dorsal about as high as long, the longest ray 1¾ in head (8½ in total length with caudal, according to Fabricus). Dark green, with lighter irregular green streaks, silvery below; sides everywhere with pale pink spots, the largest less than eye; upper fins greenish; lower pink. Sea-run specimens nearly plain silvery. Waters of Greenland, Boothia, and neighboring regions, abundant; the specimen examined by us (described in full by Dresel) from Godhavn, Disco Island. (*stagnum*, a pond or tarn.)

*Salmo stagnalis*, FABRICIUS, Fauna Grœnlandica, 175, 1780, Alpine ponds of Greenland; not migratory.

*Salmo rivalis*, FABRICIUS, *l. c.*, 176, 1780, Alpine brooks of Greenland; not entering the sea.

*Salmo hearnei*, RICHARDSON, Franklin's First Voyage, 706, 1823, and in Fauna Bor.-Amer., III, 167, 1836, Bloody Fall, Coppermine River, lat. 67°; description imperfect; GÜNTHER, Cat., VI, 148, 1866.

*Salmo rossii*,* RICHARDSON, App. Ross's Voyage, LVI, 1835; and in Fauna Bor.-Amer., III, 163, 1836, Regent's Inlet, Boothia Felix.

*Salvelinus rossi*, JORDAN & GILBERT, Synopsis, 321, 1883.

*Salvelinus stagnalis*, DRESEL, Proc. U. S. Nat. Mus., 1884, 255; good description.

*Salmo hoodii*, RICHARDSON, Fauna Bor.-Amer., III, 173, 1836; GÜNTHER, Cat., VI, 151, 1866.

Represented in the far north by

### 785c. SALVELINUS ALPINUS ARCTURUS (Günther).

Head 4½; depth 5; D. 11; A. 10; B. 11; cœca 31–44. Dull greenish, silvery or reddish below; lower fins yellowish; no red spots (on specimens seen). Body rather elongate; head small, the snout very obtuse; mouth moderate, the maxillary in the male reaching about to posterior margin of orbit; teeth small; a band of hyoid teeth; preopercle with a distinct lower limb; pectoral little shorter than head, reaching more than halfway to ventral. Caudal moderately forked; scales minute. Length 12 inches. Victoria Lake and Floeberg Beach, Arctic America, lat. 82° 34′, the northernmost Salmonoid known. (Günther.) (*Arcturus*, ἄρκτος, bear; οὐρά, tail, name of one of the northern stars.)

*Salmo arcturus*, GÜNTHER, Proc. Zoöl. Soc. Lond., 1877, 294, pl. XXXII, Victoria Lake, Floeberg Beach. (Coll. Capt. Fielden.)

*Salvelinus arcturus*, JORDAN & GILBERT, Synopsis, 319, 1883.

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* The following is the substance of Richardson's account of *S. rossi*:

Head 5. B. 12-13; D. 13; A. 11; P. 14; V. 10. Dorsal fin low; pectoral short, adipose fin very small. Rather slender; snout very obtuse; lower jaw remarkably long, with a knob at tip (male). Thirty teeth on tongue. Conspicuous pores on the face bones posteriorly. Scales very small, embedded. Olive-brown above, the dorsal and caudal similarly colored; belly red; scattered red spots near the lateral line. (Named for Captain James Clark Ross, an Arctic explorer by whose party the species was obtained.)

Represented in lakes of Western Maine and New Hampshire by

### 785d. SALVELINUS ALPINUS AUREOLUS (Bean).

(SUNAPEE TROUT.)

Head $4\frac{1}{5}$; depth $4\frac{1}{5}$. D. 9; A. 8; scales 35–210–40. Maxillary reaching middle of eye, $2\frac{2}{3}$ in head; eye a little longer than snout, $4\frac{2}{7}$ in head; gill rakers usually* about 6 + 12, quite short, not $\frac{1}{3}$ diameter of eye, and angularly bent; (in *alpinus*, longer, straighter, 7 + 14, and $\frac{2}{5}$ eye); pectoral shortish, $1\frac{2}{3}$ in head, longer in males; dorsal rather low. Brownish, sides silver gray, with small orange spots on sides above and below lateral line; caudal grayish; belly orange; anal orange, edged before with white; ventrals orange, with a white band on outer rays; no mottlings anywhere. Length 12 to 18 inches. Sunapee Lake, New Hampshire, Dan Hole Pond, Carroll County, New Hampshire; tributary to Saco River, and Flood's Pond, Ellsworth, Maine, tributary to Union River. Evidently almost or quite identical with the European Charr, and considered by Garman as probably introduced into these ponds from Germany.

In referring to the trout from Sunapee Lake, Mr. Quackenbos writes: The external characteristics of the Sunapee fish, however, distinguish it conspicuously from the three other charrs of New England. Its graceful build, small and delicately-shaped head, small mouth, excessively developed fins, more or less markedly emarginate caudal, spots without the blue areola, and unmottled back, at once separate it from the brook trout and link it as closely as its structural peculiarities with Austrian, British, and Swiss congeners. The nuptial coloration is gorgeous beyond example among our indigenous *Salmonidæ.* Throughout the spring and summer the back is dark sea-green, blending on the sides into a flashing silver, which in turn deepens below into a rich cream. But as the October pairing time approaches, the fish is metamorphosed into a creature of indescribable brilliancy. The deep purplish blue of the back and shoulders now seems to dissolve into a dreamy sheen of amethyst, through which the inconspicuous pale lemon spots of midsummer flame out in points of yellow or vermilion fire, while below the lateral line all is dazzling orange. The fins catch the hue of the adjacent parts, and pectoral, ventral, anal, and lower lobe of caudal, are ribboned with a broad white margin. As in the case of the Windermere charr, these white margins of the fins are very conspicuous in specimens seen swimming in the water. There are great differences in intensity of general coloration, and the females are not usually as gaudily tinted as the males. The intermediate types and different depths of hue observable in an autumn school recall the public promenade in a West Indian city, where all shades of transition are found from pure white to tawny black. Those who have seen the flashing hordes on the spawning beds, in all their glory of color and majesty of action, pronounce it a spectacle never to be forgotten.

The Sunapee charr is undoubtedly a representative of the European form; but reasons have been given why it is believed to be a native of this continent. It differs no more extensively from the several European varieties than they do among themselves. Von dem Borne, Professors Benecke, Dalmar, and Wittmack, of Berlin, all speak of important differences in form, size, and color, according to age, sex, season, and habitat. All authorities allude to the solid sea-green or dark-blue of the back, the yellowish sides, and the red or orange belly. Benecke and Dalmar refer picturesquely to the half-moon tail. As to spots, there is endless variety. Some forms have none; some, large spots; others, small—yellow, orange, and red—and singularly, in certain specimens, each spot is surrounded by a white ring or halo. The fins take their color from the back and sides, and have the broad white band. The foreign saïbling is gregarious like the Sunapee form; lives similarly on crustaceans, worms, and fish-food, and seeks the deepest and coldest waters.

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* The value of gill rakers as a distinctive character is questioned by Garman, Bean, and Quackenbos. It is not unlikely that these structures vary with age, food, and condition, and are subject to deterioration in large trout. Garman says that in foreign specimens examined by him the dentition differs, corresponding more or less nearly with that of the New Hampshire fish—that differences of age imply radical differences in teeth, fins, stomach, and especially gill rakers—which latter Garman believes to be "most important in function early in life and to deteriorate with change to coarser food." The deterioration consists in a distortion not alike in any two individuals; "the rakers curve and twist in every direction like a lot of writhing worms suddenly become rigid." "In old specimens, they lose their points and grow club-shaped.—*Quackenbos.*"

The greater the altitude the more intense the coloration and the smaller the fish. In Lake Zug the saïbling run 8 or 9 to the pound; in Lake Geneva, they are said to attain a weight of over 20 pounds. The flesh is white or red, which, however, makes no difference in the flavor. The foreign saïbling is taken in nets, or with hook and line; it is eaten fresh or smoked.

In Forest and Stream, Jan. 22, 1891, Dr. Jordan gave his reasons for thinking with Bean, Quackenbos, and others that the Sunapee trout is a native variety of *Salvelinus alpinus*, as follows: "For some time past ichthyologists and anglers alike have been deeply interested in the question of the name and origin of the splendid trout of Sunapee Lake. Is it a distinct and peculiar species which has always been with us, or is it simply the European charr or saibling which has been lately brought over from Europe? Two of our highest ichthyological authorities have expressed themselves with some positiveness in regard to this matter. Dr. Tarleton H. Bean, of the United States Fish Commission, has described the fish in question as a distinct species, under the name of *Salvelinus aureolus*, while Mr. Samuel Garman, of the Museum of Comparative Zoölogy, has declared it to be fully identical with the European *Salvelinus alpinus*, the charr, saibling, sälbling or *ombre chevalier* of the rivers and lakes of northern Europe. On the supposition of the identity of the Sunapee trout with the European form, its occurrence in the lakes of Maine has been attributed to a recent plant of saibling eggs brought from Germany by the United States Fish Commission. The possibility that this trout is a hybrid between the saibling and the European trout or brown trout (*Salmo fario*), has been also suggested.

The study of the species of charr is a very difficult one. The specific differences are slight and the individual variations surprisingly great. The presence of a large amount of material is necessary in order to reach any conclusion. Those conclusions which now seem to me probable I wish to present in the most modest manner possible, for they are liable to be wholly overturned when the waters between Maine and Greenland are more fully explored.

For the purposes of the present study, Dr. Bean has very kindly lent me a considerable amount of material, from the National Museum, by consent of Dr. Goode. This consists of the following specimens:

*Salvelinus alpinus*—10249, from Europe; 17456 (two specimens), Bergen; 39924, Sterling Lake, New Jersey (introduced).

*Salvelinus aureolus*—From Sunapee Lake, 37408, 37409, 37410, 39334, 39335, 39900.

*Salvelinus*—A hybrid of *Salvelinus alpinus*, male with *Salmo fario*, female, 2 years old, received from Norway, 17451.

*Salvelinus* (*nitidus*)—34384, Disco, Greenland.

*Salvelinus* (*arcturus*)—36097, mouth of St. Lawrence River; 37670, lake near Quebec.

Besides these specimens I have received several specimens of *Salvelinus aureolus* from Sunapee Lake and Dan Hole Pond, through the kindness of Mr. A. N. Cheney and others. From Dr. Bean I have also specimens of *S. oquassa* from Rangeley Lake, and of *S. fontinalis agassizii*, from Monadnock Lake. There is, however, no present question of the distinctness of the Sunapee trout from either *fontinalis* or *oquassa*, though its relations to the latter are very close.

From the material in hand the following conclusions seem justifiable, and I am pleased to find that these results agree in the main with the observations both of Dr. Bean and of Mr. Garman.

1. In comparing the specimens of *aureolus* with those of *alpinus* I find a very close agreement in all external respects, some of the specimens in hand coinciding, as Mr. Garman has noticed, in almost every detail with one of Dr. F. A. Smitt's colored figures of *alpinus* from Sweden. I find, however, the following distinctions constant in these specimens, these differences being substantially those already pointed out by Dr. Bean.

In *aureolus* the gill rakers, 6 + 11 or 6 + 12 in number, are quite short, less than ⅓ diameter of eye, and angularly bent outward, the oldest specimens having them shortest in proportion and most curved.

In *alpinus* the gill rakers are 7 + 15 or 7 + 14 in number, longer and straighter than in *aureolus*, ⅖ length of eye in specimens of the same length as those of *aureolus* measured. In form of gill rakers and in all other respects the specimen from Sterling Lake introduced (from Germany) agrees fully with the Norwegian saiblings.

In *aureolus* the pectorals are shorter (1⅔ in head) and the dorsal lower than in *alpinus*. In the latter the pectoral is 1⅓ to 1¼ in head.

Other apparent differences which may depend wholly or in part on the condition of the specimens are these: The hyoid (hypobranchial) teeth in *aureolus* are smaller and in a broader series than in *alpinus*, the stomach a little thicker and the pyloric cœca smaller. I doubt the constancy of these characters. The specimens of *aureolus* are also a little more robust in form, a character of trifling value among trout.

Dr. Day has recently maintained, and he has shown good cause for his opinion, that the six or eight nominal species of charr ascribed to the waters of Great Britain are all forms of one—*Salvelinus alpinus*. Recent continental writers seem to share this view, long ago advanced by Agassiz, who placed all the charrs of Europe, including Iceland, in a single species, *alpinus*. Dr. Day has shown that the species is subject to great variation in the development of the pectorals. None of the European writers has paid much attention to the gill rakers. Dr. Günther has counted in English specimens 9 and 11 gill rakers on the lower limb. If these counts are correct, the number would vary from 6 + 9 to 9 + 15. But this count may be questioned, as it is not unlikely that some of the smaller ones have been omitted in Dr. Günther's enumeration. When all these facts are taken into consideration, the only character left to distinguish the Sunapee charr from the saibling is the curved form and perhaps lesser number of its gill rakers.

This problem is complicated by the existence of other saibling-like charrs in lakes of Canada and Greenland. It is evident, too, that some of these are even more like the saibling than the Sunapee trout is, a fact which Dr. Bean has already pointed out in a letter to me.

The specimen above mentioned from Disco, Greenland, is a fine trout, 15 inches long, wholly silvery in color, a fact which shows that it was taken in the sea. This specimen has the gill rakers slender and straightish, 9 + 15 in number, the longest 2⅓ in eye. In this respect it agrees perfectly with the saibling, but in the form of the body and the shortish fins (the pectoral 1⅔ in head) it more resembles the Sunapee trout. This Greenland fish represents the species called *Salvelinus nitidus* (Richardson). This has been thought to be simply the female of a long-finned Greenland trout, called *Salvelinus stagnalis* (Fabricius). Perhaps *nitidus* is the female and *stagnalis* the male, or perhaps *stagnalis* is based on river and *nitidus* on sea-run specimens. Apparently the two are not distinct species and I do not see how either can be separated from *alpinus*. Apparently, also, *nitidus* only differs from *aureolus* in having the gill rakers of *alpinus*. An unpublished engraving of another Greenland trout (*nitidus*) agrees perfectly in form and color with *aureolus*, but the gill rakers are not shown.

In view of all these facts, I have no hesitation in regarding these Greenland charrs as forms of the saibling. That the saibling should extend its range across to Greenland need not surprise us. It is found in all the mountain lakes of Europe from Austria to Spitzbergen. It enters the northern seas and swarms in the ponds of Iceland. In late autumn, in the North Pacific, black-spotted trout (*Salmo mykiss*) and the Dolly Varden charr (*Salvelinus malma*) freely enter the ocean, and they inhabit alike both sides of Bering Sea. The saibling could as easily reach Greenland from Iceland as to cross to Iceland from the Scottish coasts.

Two other specimens before us are also of interest in this connection. One of these, a young trout, 10¾ inches in length, with parr marks and without red spots, is from a lake near Quebec. The other, 9¾ inches long, was taken in the Gulf of St. Lawrence. This specimen is very dark in color, almost like a blueback. It has no red spots and its scales have the silvery luster which is acquired on entering the sea. [These belong to the form since described as *Salmo marstoni*, Garman; previously recorded by Dr. Bean as *Salvelinus rossi*.]

These two specimens seem to agree with each other in essentials. They have straightish gill rakers like the saibling, but their number of these appendages (7 + 12 and 7 + 14) is intermediate between the saibling and the Sunapee trout. The pectoral fins are also intermediate in length, 1⅖ in head in one specimen, 1⅗ in the other. The opercular bones seem more straight than in any other specimens examined, but this appearance may be due to the fact of the partial drying of the skin over the bones before the fish was put into alcohol. These specimens are apparently intermediate between the saibling and the Sunapee trout, and again intermediate between the Greenland *nitidus* and the Sunapee fish. The specimen from Quebec agrees in all respects, waiving nonessentials, with Dr. Günther's figure of *Salvelinus arcturus*, the "northernmost Salmonoid known," from the northern limit of British America. Dr. Bean has suggested to me that this specimen may be the unrecognized *Salvelinus rossi* of Richardson. This view may be correct, but Richardson's description is so vague that we can only be sure that his fish was some one of the *alpinus* set, with red spots and a red belly, perhaps a *nitidus* or *stagnalis*.

The Sunapee charr is certainly not a hybrid between the saibling and any other species, European or American. The hybrid *alpinus* X *fario*, examined by me, has the scales adherent as in *alpinus*, but almost as large (135 series) as in *Salmo fario*. Its gill rakers, 6 + 11 or 12, are stiffish and nearly straight; there are a few teeth on the shaft of the vomer (*fario* has many, the species of *Salvelinus* none at all) and the color is very eccentric. The body is dark and is clouded all over with sharply defined yellowish reticulations, which extend on the head and fins. Its coloration somewhat resembles that of a pike. It has neither the red spots of *alpinus* nor the black spots of *fario*.

In this connection we may briefly notice the other nominal species of charr described from British America and Greenland. *Salvelinus arcturus* seems to be a form or variety of *S. alpinus* as already noticed. The same is true of *Salvelinus nitidus* and of *Salvelinus stagnalis*. *Salvelinus alipes* is the same as *stagnalis*, and *rossi* probably identical with *nitidus*, as is also *Salvelinus hearnii*. *Salvelinus hoodi* was based on a mixed lŏt of *Salvelinus fontinalis* and *S. namaycush*. *Salvelinus hudsonicus*, *canadensis*, and *immaculatus* are *fontinalis*, the latter name given to sea-run specimens. But for all we know the *alpinus* may run out to sea as well and become *immaculatus*, too. *Salvelinus naresi*, from the Arctic regions, seems to be the same as *oquassa*. If these views be correct, we have in America five species of charr, each highly variable and running into many local varieties.

As for the Sunapee charr itself, we may say that it seems to be distinguished from all the other forms of charr by its gill rakers. It is probably not a distinct species, and it is probably native to the waters in which it is now found, and not an importation from Europe. Should it appear, however, that the saibling in that part of Germany from which specimens have been brought to America have gill rakers like those of the Sunapee trout, this opinion would be reconsidered. Other lakes of Maine, Quebec, Labrador, and Boothia must be explored before these questions can be definitely settled.

It is interesting to notice that just as the right of the saibling to be regarded as a native American has been questioned in this country, so has its citizenship in England been also denied. Dr. Day tells us that in olden times the people were 'taught that three sons of the church introduced these fishes into Wales from Rome, and placed two in each of the lakes of Llanberries, Llynumber, and Trevennyn.' Perhaps we are justified in supposing that by the same persons and at the same time two were placed in Sunapee Lake, two in Dan Hole Pond, and two in the sea at Disco."

*Salvelinus aureolus*, Bean, Proc. U. S. Nat. Mus., 1887, 628, **Sunapee Lake, New Hampshire.** (Type, Nos. 37408 and 39334. Coll. Col. E. B. Hodge and Dr. J. D. Quackenbos.)

*Salvelinus alpinus aureolus*, Jordan, Forest and Stream, Jan. 22, 1891; Quackenbos, Trans. N. Y. Ac. Sci., xii, 1893, 139.

*Salmo alpinus*, Garman, American Angler, Feb. 5, 1891.

### 486. SALVELINUS OQUASSA (Girard).

(Oquassa Trout; Blueback Trout; Quasky.)

Head 5; depth 5; eye large, 3½ in head. D. 10; A. 9; scales 230; gill rakers about 6 + 11. Body elongate, considerably compressed, less elevated than in the other species of this genus, the dorsal outline regularly but not strongly curved. Head quite small, smaller than in any other of our trout, its upper surface flattish; mouth quite small, the maxillary short and moderately broad, scarcely extending to the posterior margin of eye. Jaws about equal. Scales small, those along the lateral line somewhat enlarged. Pectoral and ventral fins not elongate; caudal fin well forked, more so than in the other species; preopercle as in *S. fontinalis*, but the lower limb more developed; opercles without concentric striæ. Coloration dark blue, the red spots small and round, much smaller than the pupil, usually confined to the sides of the body; sides with traces of dark bars; lower fins variegated, as in *S. fontinalis*. Length 12 inches. Smallest and handsomest of the charrs, as yet known only from the Rangeley Lakes in western Maine. Although quite different in appearance, it shows no important structural differences from *S. alpinus*, and may prove to be a variety of that species. (*Oquassa* or *Oquassoc*, name of one of the Rangeley Lakes.)

*Salmo oquassa*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 262, Oquassa Lake, Maine; GÜNTHER, Cat., VI, 154, 1866.

*Salvelinus oquassa*, JORDAN, Proc. U. S. Nat. Mus., I, 1878, 81; JORDAN & GILBERT, Synopsis, 318, 1883.

Represented in Arctic America by the scarcely different

### 786a. SALVELINUS OQUASSA NARESI (Günther).

Head 4¼; depth 5–6. D. 11; A. 9; B. 11; cœca 42; vertebræ 65. Greenish above, sides silvery or deep red, with very small red spots, much smaller than pupil; lower fins deep red, with the anterior margins yellowish white; dorsal red posteriorly. Body long and slender; head rather small, the snout blunt; the forehead flat; mouth not large, maxillary reaching posterior margin of orbit in male only; teeth very small; teeth on the middle line of the hyoid bone; angle of preopercle much rounded; gill covers with scarcely a trace of the concentric striæ for which *S. nitidus* is distinguished; pectoral not longer than the head without snout; reaching halfway to ventrals; ventrals not to vent; caudal deeply forked; scales minute. Length 10 inches. (Günther.) Lakes of Arctic America, Discovery Bay, and Cumberland Gulf. (Named for Captain George Nares, in charge of the exploring expedition by which it was taken.)

*Salmo naresi*, GÜNTHER, Proc. Zoöl. Soc. London, 1877, 476, plate, fresh-water lakes near Discovery Bay.

*Salvelinus naresi*, BEAN, Bull. U. S. Nat. Mus., XV, 1879, 135; JORDAN & GILBERT, Synopsis, 318, 1883; DRESEL, Proc. U. S. Nat. Mus., 1884, 255; compares *naresi* with *stagnalis*. In *S. naresi*, the eye is very much larger, the snout is much shorter, the maxilla does not extend beyond the posterior margin of the eye, and the gill rakers are longer and more numerous. In *stagnalis*, DRESEL says that the gill rakers are 9 + 14 or 15, the longest ½ eye.

Closely allied to *Salvelinus oquassa*, and perhaps a variety either of it or of *S. alpinus* is

### 786b. SALVELINUS OQUASSA MARSTONI,* Garman.

(THE LAC DE MARBRE TROUT.)

B. 11, 12; D. 13; A. 13; V. 9; P. 14; vertebræ 60. Gill rakers straight, short, sharp, rough, 8 + 14 on the first arch. The specimen described is about 12 inches in length. Body subfusiform, compressed, pointed at snout, slender at the tail. Height of body near $\frac{1}{6}$ of the total length; head $\frac{1}{5}$, crown convex. Snout $1\frac{1}{3}$, and interorbital space $1\frac{1}{2}$ times the eye. Eye little less than $\frac{1}{5}$ of the head, $\frac{2}{3}$ of the space between the orbits on the forehead. Mouth large; maxillary straight, extending backward almost as far as the hinder edge of the eye, bearing strong teeth on its lower edge for nearly its entire length. Teeth on intermaxillary and mandibles stronger. The tongue bears a series of four strong hooked teeth at each side, and behind the glossohyal on the basibranchials there is a band of several series of smaller ones. Opercle thin, with a few striæ. Scales very small; apparently there are about 230 in the series immediately above the lateral line, and more than 250 in a row 5 or 6 scales above this. Distance from first ray of dorsal to end of snout little more than that from the same ray to the tip of the adipose fin. The middle of the total length falls halfway between the ends of the hinder rays of the dorsal and its base. Dorsal and anal fins are slightly emarginate at the ends of their median rays. Pectorals and ventrals small; base of latter slightly behind the middle of that of the dorsal. Caudal pedicle slender, notch very deep, hinder border sinuous, as in *Salmo alpinus*, lobes pointed. The caudal notch is deeper in this species than in any other of the American forms except *C. namaycush*.

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* Dr. Bean furnishes us the following notes on a specimen, doubtless identical with *S. marstoni* and formerly referred by us to *Salvelinus alpinus*, called by him

SALVELINUS ROSSI (No. 37670).

Township of Decalonnes, Quebec, 70 miles east and 40 miles north of Montreal. Received from Mr. Blackford, February 10, 1886; caught by C. H. Simpson. Length 10½ inches; sex not to be ascertained. Above steel blue. Seven or eight broad parr marks along the sides, very indistinct, and separated by very much narrower yellowish interspaces. Lower half of body pink, overlaying a yellowish ground. Pectoral dusky at base and along most of its upper half, the rest running into orange. Ventrals red, the outer margin milk-white. Anal red, the outer anterior margin milk-white. Lower caudal lobe reddish along its lower margin. Eye dusky, mingled with bronze. Gill rakers about 8 + 12, rather short and feeble, longest about ½ length of iris. Teeth in jaws and on tongue very strong. Closely related to *alpinus*, from which it seems to differ in the shape of the subopercle; this bone is twice as long as deep and is conspicuously striated. The hyoids are well developed, in a long and unusually broad band for the genus *Salvelinus*.

Back dark brown, with an iridescent bluish tint, unspotted; dorsals dark, clouded, without spots or bands; pectorals, anal, and ventrals orange in the middle, yellowish or whitish toward bases and at their margins. The dark color of the back shades into whitish, tinged with pink below the lateral line; ventral surface white, no doubt reddish in breeding season; head black on top, silvery on the cheeks, white beneath. Flesh pink. Caudal fin yellowish toward the base, brown toward the hinder border, which has a narrow edging of light color; faint areas of lighter tint suggest a few spots of red in life along the lateral line; the condition of the specimens is such that this may be left in question, as also the number of cœca or presence of parr bands, of which there are faint indications.

This fish is evidently allied to the blueback of the Rangeley Lakes, *S. oquassa*, but reaches a greater size than that species, and is readily distinguished by the maxillary and its dentition, the caudal fin, and the coloration. Similarly when compared with *S. arcturus*, *S. stagnalis*, and *S. rossi*, it is seen to be quite distinct. With the saibling, *S. alpinus*, introduced in Sunapee Lake and elsewhere, it has still less in common.

Our specimens were taken in Lac de Marbre, Ottawa County, Province of Quebec, Canada, whence they were sent by favor of the Hon. J. G. A. Creighton. They reached us at the instance of Mr. A. N. Cheney. (Garman.) (Named for R. B. Marston, editor of *Fishing Gazette*, London.)

*Salmo marstoni*, GARMAN, Science, July 14, 1893, 23, Lac de Marbre, Ottawa County, Quebec.

## Family LXV. THYMALLIDÆ.

### (The Graylings.)

The family contains Salmonoid fishes, with ripe ova first discharged within abdominal cavity, branchiostegals 8–10 (11), pyloric cœca in moderate number, a rather long dorsal fin, whose anterior half is composed of simple unbranched rays, and posterior half of bifurcate or little branched rays, epipleural spines to anterior ribs, and the parietal bones meeting at middle and excluding frontals from supraoccipital. (Gill.) The graylings agree closely with the *Salmonidæ* in external characters and in habits. They, however, differ notably in the structure of the skull, as above indicated. The conventional statement that they are intermediate between the trout and the whitefishes is not borne out by the skeleton. One genus with about five species; beautiful fishes of the rivers of cold or Arctic regions, active and gamy and valued as food. (*Thymallidæ*, Gill, Proc. U. S. Nat. Mus., 1894, 121.)

## 238. THYMALLUS, Cuvier.

### (Graylings.)

*Thymallus*, Cuvier, Règne Anim., Ed. 2, II, 306, 1829, (*thymallus*); not *Thymalus*,* Latreille, 1802, a genus of *Coleoptera*.

*Choregon*, Minding, Lehrbuch, Naturgesch. Fische, 119, 1832, ((*thymallus*).

Body oblong, compressed, little elevated. Head rather short; mouth moderate, terminal, the short maxillary extending past the middle of the large eye, but not to its posterior margin. Teeth slender and sparse on the maxillaries, premaxillaries, and lower jaw; vomer short, with a small patch of teeth; teeth on the palatines; tongue toothless, or nearly so. Gill openings wide. Branchiostegals 7 or 8. Gill rakers short and rather stiff. Suborbital and preorbital bones narrow. Scales small and loose, 75 to 100 in the course of the lateral line. Dorsal fin very long and high, mostly in advance of the ventrals, of about 20 rays, of which the anterior half are slender and simple, most of the others simply bifid; adipose fin small; caudal fin forked; anal fin small, of 10–15 rays. Pseudobranchiæ well developed. Air bladder very large. Pyloric appendages about 15. Coloration brilliant, the dorsal with red or blue spots. Beautiful fishes of the fresh waters of northern regions. (*Thymallus*, an ancient name of the Grayling, the fish having the odor of thyme, θύμος.)

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| *a.* Dorsal fin very high, with 22 to 24 rays. | SIGNIFER, 787. |
| *aa.* Dorsal fin moderate, of 19 to 21 rays. | ONTARIENSIS, 788. |

### 787. THYMALLUS SIGNIFER (Richardson).

#### (Arctic Grayling; Poisson Bleu.)

Head 5½; depth 4⅔; eye 3. D. 24; A. 11; scales 8–88 to 90–11; cœca 18. Body elongate, compressed, highest under the anterior portion of the dorsal. Head rather short, subconic, compressed, its upper outline continuous with anterior curve of the back. Mouth moderate, the maxillary extending to below the middle of the eye; maxillary 6 in head; jaws about

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*Those who think that the two names (*Thymalus* and *Thymallus*) conflict, may take the name *Choregon* in place of *Thymallus*.—*Gill*.

equal. Tongue, in the young, with teeth which are usually absent in the adult. Eye quite large, rather longer than snout, about equal to the interorbital space. Scales moderate, easily detached; lateral line nearly straight; a small bare space behind isthmus. Dorsal fin long and high, its length rather greater than the depth of body, its height varying, about 3½ in length of body, greatest in the males; adipose fin rather small; anal fin small. Gill rakers slender, short, about 12 below the angle. Back dark, sides purplish-gray; belly blackish-gray, with irregular whitish blotches; five or six deep-blue spots anteriorly; head brown; a blue mark on each side of lower jaw; dorsal dark gray, blotched with paler, with crossrows of deep-blue spots, edged with lake red; ventrals striated with reddish and whitish. Length 18 inches. Mackenzie River to Alaska and the Arctic Ocean; Kowak River (C. H. Townsend); abounding in clear cold streams. Our specimens from Fort Simpson. (*Signifer*, standard bearer.)

*Coregonus signifer*, Richardson, Franklin's Journ., 1823, 711, Winter Lake, near Fort Enterprise.

*Coregonus thymalloides*, Richardson, Fauna Bor.-Amer., 714, 1836, Winter River.

*Salmo* (*Thymallus*) *signifer*, Richardson, Fauna Bor.-Amer., III, 190, 1836.

*Thymallus signifer*, Günther, Cat., VI, 202, 1866; Milner, Rept. U. S. Fish Comm., II, 1872–73 (1874), 738; specimens from Fort Simpson, Yukon River, and St. Michaels; Jordan & Gilbert, Synopsis, 302, 1883.

### 788. THYMALLUS ONTARIENSIS, Cuvier & Valenciennes.

(Michigan Grayling.)

Head rather larger, about 5 in length; scales about the same, 93 to 98; dorsal fin lower and smaller than in *T. signifer*, with 21 or 22 rays. Coloration brilliant, purplish-gray; young silvery; sides of head with bright bluish and bronze reflections; sides of body with small, black irregular spots, most numerous posteriorly in young specimens; ventral fins ornate, dusky, with diagonal rose-colored lines; dorsal with a black line along its base, then a rose-colored one, then a blackish one, then rose-colored, blackish, and rose-colored, the last stripe continued as a row of spots; above these is a row of dusky-green spots, then a row of minute rose-colored spots, then a broad dusky area, the middle part of the fin tipped with rose; anal and adipose fins dusky; central rays of caudal pink, outer rays dusky. Streams of northern Michigan, formerly abundant in Au Sable River, Jordan River, and other streams in the Southern Peninsula. Also in Otter Creek, near Keweenaw, in the Northern Peninsula, whence specimens have been sent us by David D. Banta. These Michigan localities evidently represent a detached colony, left from the former or post-Glacial extension of the range of *T. signifer*, of which this was once a variety. It is a beautiful and gamy fish, but is being rapidly exterminated through the influence of anglers and sawmills.

*Thymallus ontariensis*,* Cuvier & Valenciennes, Hist. Nat. Poiss., XXI, 452, 1848; said to have been brought by Milbert, from Lake Ontario.

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*The following is a translation of Valenciennes' account of *Thymallus ontariensis:* We have received from Lake Ontario a *Thymallus* very near to that of the lake of Geneva. It has, however, more naked space under the throat, although less than in *Thymallus gymnothorax*. The head is evidently more pointed, the body more elongate, the dorsal a little longer. The denticulations of the scales are more pronounced. The colors seem scarcely to differ from those of *Thymallus*, for our specimens are greenish, with a dozen gray lines along the flanks. The dorsal has 4 or 5 longitudinal streaks of red. Our specimens are a foot long; they have been sent by M. Milbert.—(*Valenciennes, l. c.*)

*Thymallus tricolor*, Cope, Proc. Ac. Nat. Sci. Phila., 1865, 80, Au Sable River, Michigan; Günther, Cat., vi, 201, 1866; Milner, Rept. U. S. Fish Comm., ii, 1872–73 (1874), 739, and of late writers on angling generally.

*Thymallus signifer tricolor*, Jordan & Gilbert, Synopsis, 303, 1883.

*Thymallus signifer ontariensis*, Jordan, Bull. U. S. Fish Comm., x, 1890, 49.

Represented in the head waters of the Missouri by another isolated colony,

### 788a. THYMALLUS ONTARIENSIS MONTANUS (Milner).

(Montana Grayling.)

Depth 5½[*] in length, as in other forms; scales 99, and (in specimens examined) a little different in color. Dorsal dusky green, its posterior part with three rows of bright-orange spots, faintly ocellated, irregular in position, some of the spots oblong and placed obliquely; above this one regular row of similar spots, extending obliquely across the fin from end of second third of anterior ray to tip of last ray; fin edged with bright orange-brown. Entirely similar to the Michigan Grayling, but the dorsal a little smaller. Madison and Gallatin rivers, very abundant in springs and small streams on the west side of the Yellowstone Park, ascending streams as far as Firehole Falls and Gibbon Falls.

*Thymallus montanus*, Milner, Rept. U. S. Fish Comm., ii, 1872–73 (1874), 741, tributary of Missouri River at Camp Baker. (Type, No. 13090. Coll. J. Scott Oldmixon.)

*Thymallus signifer montanus*, Jordan & Gilbert, Synopsis, 303, 1883.

## Family LXVI. ARGENTINIDÆ.

(The Smelts.)

Body elongate, covered with moderate or small scales, which are usually cycloid. Head naked. Mouth terminal, small or large, formed as in the *Salmonidæ*, the maxillary forming the margin of the upper jaw. Teeth various, sharp-pointed. Gills 4, a slit behind the fourth. Gill membranes separate, free from the isthmus, with 6 to 10 branchiostegals. No barbels. Stomach a blind sac, with the pyloric cœca few or none. Dorsal fin short, nearly median; adipose fin always present; caudal forked; anal moderate; pectorals placed low; ventrals moderate, nearly median; no spines in the fins. Lateral line present. No phosphorescent spots. Abdomen rounded. Air bladder large, single. Ova large, falling into the cavity of the abdomen before extrusion. Small fishes, marine or anadromous, some of them inhabiting deep waters; all but one genus confined to the waters of the Northern Hemisphere. There are about ten genera and perhaps a dozen species; reduced *Salmonidæ*, smaller and in every way feebler than the trout, but similar to them in all respects except the form of the stomach. Most of them are very delicate food-fishes, and the species of *Thaleichthys* is, in this respect, preeminent among our fishes. (*Salmonidæ*, part, Günther, Cat., vi, 166–172, 203–205, 1866.)

*a.* Branchiostegals 6 to 10; body not cylindrical, the sides more or less compressed; gill membranes separate.

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[*] Not 4½ as stated by Milner.

*b.* Ventral fins inserted in front of the middle of dorsal; mouth large.
  *c.* Scales very small, arranged in the male in villous bands; teeth feeble; pectoral fins broad, of 15 to 20 rays; pyloric cœca 6. MALLOTUS, 239.
  *cc.* Scales large, similar in both sexes; pectoral fin moderate, its rays 10 to 12.
    *d.* Teeth feeble, those on tongue very weak; scales small, adherent. THALEICHTHYS, 240.
    *dd.* Teeth strong, those on tongue enlarged, canine-like; scales moderate, loosely attached. OSMERUS, 241.
*bb.* Ventral fins inserted under or behind middle of dorsal; mouth rather small; scales large.
  *e.* Jaws with minute teeth; similar teeth on tongue and palate; maxillary reaching past front of eye. HYPOMESUS, 242.
  *ee.* Jaws toothless or very nearly so; vomer and palatines with small teeth; mouth small, the maxillary not reaching past front of eye.
    *f.* Tongue with a curved row of small teeth on each side; scales smooth or more or less spinescent. ARGENTINA, 243.
    *ff.* Tongue toothless; scales thin, caducous, probably not spiniferous; pyloric cœca about 9. LEUROGLOSSUS, 244.

## 239. MALLOTUS, Cuvier.

(CAPELINS.)

*Mallotus*, CUVIER, Règne Anim., Ed. 2, II, 305, 1829, (*villosus*).

Body elongate, compressed, covered with minute scales, a band of which, above the lateral line and along each side of the belly, are enlarged, and in mature males they become elongate-lanceolate, densely imbricated, with free, projecting points, forming villous bands. In very old males the scales of the back and belly are similarly modified, and the top of the head and the rays of the paired fins are finely granulated. Mouth rather large, the maxillary thin, extending to below the middle of the large eye. Teeth minute, forming single series on the jaws, vomer, palatines, and pterygoids; lingual teeth somewhat enlarged, in an elliptical patch. Lower jaw projecting. Branchiostegals 8 to 10. Dorsal inserted over ventrals; lower fins very large; pectoral fins large, horizontal, with very broad base, their rays in increased number (16 to 20). Pseudobranchiæ quite small. Gill rakers long, slender. Pyloric cœca 6, small. Ova very small. Marine species of the North Atlantic and Pacific, sometimes ascending streams. (*μαλλωτός*, villous.)

### 789. MALLOTUS VILLOSUS (Müller).

(CAPELIN; LODDE.)

Head 4½; depth about 6; eye large, 3½. D. 12; A. 18; scales about 150. Head long, pointed. Base of anal in males compressed and prominent, its anterior rays simple and stiff; pectorals reaching more than halfway to ventrals, the latter to anal. Mature males with a band of elongate scales along lateral line and along each side of belly; in very old examples the scales of back and middle of belly project beyond the skin; skin of head and rays of paired fins finely granulated. Dusky olivaceous above, grayish silvery on sides and below; opercles silvery, dotted. Arctic America, south to Cape Cod and Alaska; abundant northward, on both coasts, and in Kamchatka. A delicious little fish much valued in the far north. The eggs of the Capelin deposited in sand along Arctic shores in incredible numbers. They are washed up on the beaches, and in about 30 days they are hatched. "The beach then becomes a quivering mass of eggs and sand," from which the little fishes are borne into the sea by the waves. (*villosus*, hairy.)

*Clupea villosa*, MÜLLER, Prodr. Zoöl. Dan., 245, 1777, Greenland.

*Salmo arcticus*, FABRICIUS, Fauna Grönlandica, 177, 1780, Greenland.

*Salmo grönlandicus*, BLOCH, Ichth., VIII, pl. 99, 1794, Greenland.

*Salmo socialis*, PALLAS, Zoogr. Ross.-Asiat., III, 389, 1811, Islands between Asia and America.

*Osmerus microdon*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XXI, 385, 1848, no locality.

*Mallotus villosus*, GÜNTHER, Cat., VI, 170, 1866; JORDAN & GILBERT, Synopsis, 291, 1883; TURNER, Contr. Nat. Hist. Alaska, 102, pl. 10, 1886.

## 240. THALEICHTHYS, Girard.

(EULACHON.)

*Thaleichthys*, GIRARD, Pac. R. R. Surv., X, Fishes, 325, 1858, (*stevensi = pacificus*).

This genus is intermediate between *Mallotus* and *Osmerus*, differing from the latter in its rudimentary dentition, and in its small adherent scales. All the teeth are very feeble, slender, and deciduous, although occasionally present on all the bones of the mouth; no permanent teeth on the tongue. Scales are much smaller than in *Osmerus*, and more closely adherent; larger than in *Mallotus*, and similar in the two sexes. Coloration dusky. Small fishes of the North Pacific, somewhat anadromous, remarkable for their extreme oiliness, the oil being of a very delicate flavor. When dried they have been used as candles. (θάλεια, rich; ἰχθύς, fish.)

### 790. THALEICHTHYS PACIFICUS (Richardson).

(EULACHON; CANDLEFISH; OOLACHAN.)

Head 4⅘; depth 6. B. 8; D. 11; A. 21; P. 11; scales 75; pyloric cœca 11; vertebræ 70. Body rather elongate, slender, and less compressed than in *Osmerus*. Head long, blunter than in *Hypomesus pretiosus*, less compressed, broader, and more convex above. Mouth large, the maxillary rather narrow and long, reaching beyond the middle of the rather small eye; lower jaw projecting. Opercle with strong concentric striæ. Gill rakers numerous, rather long and slender. Ventrals large, inserted just in front of dorsal. Pseudobranchiæ small. Color white, scarcely silvery; upper regions rendered dark iron-gray by the accumulation of dark punctulations. Length 12 inches. Oregon to Alaska, ascending the rivers from Fraser River northward, in enormous numbers in the spring. An excellent pan-fish, unsurpassed by any fish whatsoever in delicacy of flesh, which is far superior to that of the trout. The flesh is very oily, but the oil has a very attractive flavor. It is sometimes extracted and used as a substitute for cod-liver oil. It is, however, solid and lard-like at ordinary temperatures.

*Salmo (Mallotus) pacificus*, RICHARDSON, Fauna Bor.-Amer., III, 226, 1836, Columbia River.

*Thaleichthys stevensi*, GIRARD, Pac. R. R. Surv., X, 325, pl. 75, figs. 1–4, 1858, Puget Sound. (Coll. Dr. Suckley.)

*Thaleichthys pacificus*, GÜNTHER, Cat., VI, 168, 1866; JORDAN & GILBERT, Synopsis, 292, 1883.

## 241. OSMERUS (Artedi) Linnæus.

### (Smelts.)

*Osmerus* (Artedi) Linnæus, Syst. Nat., Ed. x, 1758, 310, (*eperlanus*).
*Eperlanus*, Gaimard, Voy. Island and Grœnland, 1851, (*eperlanus*).
*Spirinchus* (Jonston) Jordan & Evermann, new subgenus, (*thaleichthys*).

Body elongate, compressed. Head long, pointed. Mouth wide, the slender maxillary extending to past the middle of the eye; lower jaw projecting; preorbital and suborbital bones narrow. Maxillaries and premaxillaries with fine teeth; lower jaw with small teeth, which are larger posteriorly; tongue with a few strong, fang-like teeth, largest at the tip; hyoid bone, vomer, palatines, and pterygoids with wide-set teeth. Gill rakers long and slender. Branchiostegals 8. Scales large, loose, 60 to 70 in the course of the lateral line. Dorsal small, about midway of the body, over the ventrals; anal rather long. Vertebræ about 40. Pyloric cœca small, few. Small fishes of the coasts of Europe and Northern America, sometimes ascending rivers; delicate in flesh and considerably valued as food. (ὀσμηρός, odorous; the name is equivalent to the English "smelt.")

Spirinchus (An old name used by Jonston for the smelt; equivalent to *spirling* and *éperlan*):
- *a.* Vomer with a cross series of small teeth; small, weak species spawning in the sea.
  - *b.* Body not very slender, the depth 5½ in length; commissure of mouth curved. thaleichthys, 791.
  - *bb.* Body very slender, the depth 6 in length; commissure of mouth nearly straight. attenuatus, 792.

Osmerus:
- *aa.* Vomer with 2 to 4 strong, fang-like teeth; species stronger in habit, ascending rivers.
  - *c.* Scales rather small, 66 to 68 in lateral line.
    - *d.* Maxillary not reaching posterior margin of eye; depth 6 to 6½ in length; coloration plain. mordax, 793.
    - *dd.* Maxillary reaching posterior margin of eye; depth 5½ in length; coloration brilliant. dentex, 794.

### Subgenus SPIRINCHUS, Jordan & Evermann.

### 791. OSMERUS THALEICHTHYS, Ayres.

Head 4½; depth 5½; eye longer than snout, 4 in head. D. 9; A. 14 to 16; P. 11; scales 55 to 58. Body comparatively deep and compressed. Head rather short and deep, the maxillary broad, short, its edge strongly curved, extending to opposite posterior margin of pupil; premaxillary on the level of upper part of pupil; mandible projecting, its tip somewhat curved upward. Fins high, the pectorals usually reaching ventrals, and the ventrals to anal; anal reaching about to caudal. Teeth weak; maxillary teeth scarcely visible. Olivaceous, sides silvery and somewhat translucent. Length 9 inches. Pacific coast from San Francisco northward to Bristol Bay in Alaska; rather common; a weak and feeble species; its flesh of excellent flavor, but soft and not keeping well. (*Thaleichthys*, the Eulachon, a related species of similar flavor as food.)

*Osmerus thaleichthys*, Ayres, Proc. Cal. Ac. Nat. Sci., 1860, 62, San Francisco; Günther, Cat., vi, 168, 1866; Jordan & Gilbert, Synopsis, 292, 1883.

### 792. OSMERUS ATTENUATUS, Lockington.

Head 4⅕; depth 6; eye large, 4 in head. D. 10; A. 15-17; P. 11; scales 65. Body elongate, compressed. Head rather long, somewhat pointed; maxillary extending past pupil; lower jaw projecting; maxillary rather narrow, little convex. Outline of both jaws nearly straight, less curved than in *O. thaleichthys*. Teeth on tongue strong, but much smaller than in *O. mordax*; teeth on maxillary conspicuous; front of both jaws with rather strong teeth; palatine teeth variable, usually strong. Fins low. Pectorals not reaching ventrals, nor ventrals anal, nor anal to caudal. Greenish, sides silvery. Length 10 inches. Coast of California about San Francisco. Very close to *O. thaleichthys*, and doubtfully distinct; perhaps founded on very slender or feeble specimens of the latter. (*attenuatus*, drawn out slender.)

*Osmerus attenuatus*, Lockington, Proc. U. S. Nat. Mus., 1880, 66, San Francisco; Jordan & Gilbert, Synopsis, 293, 1883.

## Subgenus OSMERUS.

### 793. OSMERUS MORDAX (Mitchill).

(American Smelt.)

Head 4; depth 6½. D. 10; A. 15; P. 13; scales 68. Body rather long and slender. Head large, with large mouth, and stronger teeth than in the other species of the genus. Small teeth along the edge of the maxillary; strong fang-like teeth on tongue and front of vomer; cardiform teeth on palatines, pterygoids, and hyoid bone; mandible with moderate teeth, its tip projecting. Maxillary extending to or a little beyond middle of eye. Scales deciduous. Dorsal fin rather posterior, the ventrals under its front; lower fins moderate, none reaching the next behind it. Gill rakers ⅔ diameter of eye. Transparent greenish above, silvery on sides; body and fins with some dark punctulations. Length 12 inches. Atlantic Coast of the United States from Virginia northward to Gulf of St. Lawrence, entering streams and often landlocked; abundant in Lakes Champlain and Memphremagog. Very close to the European *Osmerus eperlanus*, but the latter has larger scales (60), shorter gill rakers, and rather weaker teeth. (*mordax*, biting.)

*Atherina mordax*, Mitchill, Trans. Lit. & Phil. Soc. N. Y., I, 1815, 446, New York.

*Osmerus viridescens*, Le Sueur, Journ. Ac. Nat. Sci. Phila., I, 1818, 230, Coast of Maine; Günther, Cat., VI, 167, 1866.

*Osmerus mordax*, Jordan & Gilbert, Synopsis, 293, 1883.

Represented in lakes of Maine by landlocked forms, as follows:

### 793a. OSMERUS MORDAX SPECTRUM (Cope).

(Wilton Smelt.)

Head 4¼; depth 8⅓. D. 10; A. 15; scales 66-10. Eye 3 in head. Slender. Head short, with very large eye, and short mouth and maxillary. Maxillary not extending beyond middle of pupil. Small. Wilton Pond, Kennebec County, Maine; landlocked in fresh water. (Cope.) (*spectrum*, an image.)

*Osmerus spectrum*, Cope, Proc. Amer. Phil. Soc. Phila., 1870, 490, Wilton Pond, Kennebec County, Maine. (Coll. Atkins.)

*Osmerus mordax spectrum*, Jordan & Gilbert, Synopsis, 294, 1883.

### 793b. OSMERUS MORDAX ABBOTTI (Cope).

(COBESSICONTIC SMELT.)

Head 4¾; depth 7; scales 68–16. Eye smaller, 4½ in head. Stouter. Maxillary reaching posterior margin of pupil. Landlocked in Cobessicontic Lake, Kennebec County, Maine. (Cope). (Named for Dr. Charles Conrad Abbott, an ardent naturalist who has studied the habits of the fishes of Delaware River.)

*Osmerus abbotti*, COPE, Proc. Amer. Phil. Soc. Phila., 1870, 490, Cobessicontic Lake, Maine.
*Osmerus mordax abbotti*, JORDAN & GILBERT, Synopsis, 294, 1883.

### 794. OSMERUS DENTEX, Steindachner.

(RAINBOW HERRING.)

Head 4¼; depth 5½. D. 10; A. 13; V. 8; scales 66. Eye large, ⅔ length of snout. Teeth as in *Osmerus eperlanus* and *O. mordax*; maxillary reaching posterior margin of eye, its length 5 times in distance from tip of lower jaw to dorsal. Height of dorsal ½ length of head; height of anal $\frac{2}{7}$; pectoral shortish, reaching halfway to ventrals. Back pale olive, the scales edged with darker; sides above lateral line purple, changing below to blue, and then to violet and gold; silvery below with rosy sheen, the belly satin white, fins plain, slightly golden. Coast of Alaska and south on the Pacific Coast to northern China, abundant; a brilliantly colored fish, the flesh of firmer texture than in the rest of the genus. About Bristol Bay this species forms an important part of the food of the natives. (*dentex*, toothed.)

*Osmerus dentex*, STEINDACHNER, Sitzungsb. Kais. Akad. Wiss. Wien, LXI, 1870, 429, Northern China; JORDAN & GILBERT, Synopsis, 293, 1883; TURNER, Contr. Nat. Hist. Alaska, 102, plate 10, 1886; NELSON, Rept. Nat. Hist. Coll. Alaska, 313, 1887.

## 242. HYPOMESUS, Gill.

(SURF SMELTS.)

*Mesopus*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 168, (*pretiosa*).*
*Hypomesus*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 169, (*pretiosa*).

Body rather elongate, moderately compressed, covered with thin scales of moderate size. Head rather pointed. Mouth moderate, the shortish maxillary not extending quite to middle of eye its outline below broadly convex; lower jaw projecting. Teeth minute, on jaws, vomer, palatines, pterygoids, and tongue. Ventrals inserted directly under middle of dorsal, midway between eye and base of caudal. Branchiostegals 6 to 7. North Pacific. (ὑπο, below; μέσος, middle; in allusion to the position of the ventrals.)

*a.* Scales small, about 70 in lateral line; coloration pale; spawning in surf. PRETIOSUS, 795.
*aa.* Scales moderate, about 58 in lateral line; coloration dark; spawning in ponds. OLIDUS, 796.

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* By inadvertence these two synonymous names were applied to this genus by Gill. *Mesopus* has priority of a page. Its occurrence is however an error of the proof reader as its author intended to substitute *Hypomesus* for it, and did so in every place except in the first use of the word where *Mesopus* was inadvertently left. A slip of this sort should apparently be treated as a misprint and not considered in nomenclature.

### 795. HYPOMESUS PRETIOSUS (Girard).

(SURF SMELT.)

Head 4½; depth 4¾; eye as long as snout, 4½ in head. D. 10; A. 15; P. 14; V. 8; scales 70. Fins low, the longest dorsal ray 8 in length without caudal; pectorals scarcely reaching halfway to ventrals, 7 in length of body; ventrals not reaching vent, their length 8⅓ in body. Light olivaceous; a silvery band along the lateral line. Length 12 inches. Coast of California and Oregon, from Monterey northward; abundant, spawning in the surf. A firm-fleshed and fat little fish of delicate flavor, scarcely inferior to the eulachon. (*pretiosus*, precious.)

*Argentina pretiosa*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 155, San Francisco.
*Osmerus elongatus*, AYRES, Proc. Cal. Ac. Nat. Sci., 1854, 17, San Francisco.
*Osmerus pretiosus*, GIRARD, Pac. R. R. Surv., x, 324, 1858.
*Hypomesus pretiosus*, JORDAN & GILBERT, Synopsis, 294, 1883.

### 796. HYPOMESUS OLIDUS (Pallas).

(POND SMELT.)

Scales 56 to 60. Fins nigher than in *Hypomesus pretiosus*, the longest dorsal ray 6 in length of body; pectorals reaching ⅔ the distance to root of ventrals, their length 5 in body; ventrals 6 in length of body. Coloration dusky, little translucent. Alaska and Kamchatka, spawning in fresh-water ponds, excessively abundant about St. Michaels. A sweet little fish, excellent as food. (*olidus*, oily.)

*Salmo* (*Osmerus*) *olidus*, PALLAS, Zoogr. Ross.-Asiat., III, 391, 1811, lakes and rivers of Kamchatka.
*Mesopus olidus*, GÜNTHER, Cat., VI, 169, 1866; in part.
*Hypomesus olidus*, JORDAN & GILBERT, Synopsis, 295, 1883; TURNER, Contr. Nat. Hist. Alaska, 103, 1886.

## 243. ARGENTINA (Artedi) Linnæus.

(ARGENTINES.)

*Argentina* (ARTEDI) LINNÆUS, Syst. Nat., Ed. x, 1758, 315, (*sphyræna*).
*Silus*,[*] REINHARDT, Bemærkinger Skandinavisk Icththyol., 11, 1833, (*silus*).
*Acantholepis*, KRÖYER, Danmarks Fiske, III, 98, 1846–'49, (*silus*).

Body oblong, covered with rather large cycloid scales, which are more or less rough with spinous points. Mouth small, the maxillaries very short, not reaching to the eye; eye very large. Jaws toothless; an arched series of minute teeth on the head of the vomer and on the fore part of the palatine; tongue with a series of small curved teeth on each side. Dorsal fin short, in advance of the ventrals; caudal fin deeply forked. Eggs small. Pyloric cœca present. Branchiostegals 6. Air bladder, according[†] to Cuvier, without duct. Fishes of deep or cold waters, never entering fresh streams. (Latin *argentum*, silver.)

*a.* Scales spinigerous; body deep, the depth 5 to 5½ in length; eye longer than snout; scales small, 60 to 66. SILUS, 797.

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[*] The genus *Silus* (Norwegian Sil or Sild, herring) is founded on a species with spinescent scales. But it is not certain that any species has really smooth scales, and in *Argentina sphyræna*, the type of the genus, according to Day, the scales are provided with stellate spinules.

[†] This alleged character needs verification.

*aa.* Scales nearly or quite smooth.

*b.* Body rather deep, the depth 5½ in length; scales 40 to 45; eye shorter than snout. SIALIS, 798.

*bb.* Body rather slender, the depth about 7 in length; scales about 51; eye longer than snout. STRIATA, 799.

### 797. ARGENTINA SILUS, Ascanius.

Head 4⅓; depth 5⅓; eye 2⅘. B. 6; D. 12; A. 13; V. 14; scales 3–60–4 (66, Günther). Body compressed. Head not quite twice as long as deep; snout nearly 3½ in head. Insertion of dorsal midway between snout and adipose fin; ventrals under last ray of dorsal. Scales very large, cycloid, covered with spinules, the points of which are turned backward; a median row of scales along the back and belly. Color olivaceous; sides silvery. Length 17 inches. Northern Europe, occasionally taken on the Grand Banks and off the coast of Maine. (Goode & Bean.) (*Sild*, Norwegian word for Herring.)

*Argentina silus*, ASCANIUS, Icon. Rev. Nat., pl. III, 3, 24, 1763, Norway; JORDAN & GILBERT, Synopsis, 294, 1883; GÜNTHER, Cat., VI, 202, 1866.

*Silus ascanii*, REINHARDT, Bemærk. Skandinav. Ichth., 11, 1833, Norway.

*Argentina syrtensium*, GOODE & BEAN, Proc. U. S. Nat. Mus., 1878, 261, off Sable Island in 200 fathoms, from stomach of *Phycis tenuis*. (Type, No. 21624. Coll. R. L. Newcomb.)

### 798. ARGENTINA SIALIS, Gilbert.

Head 3; depth 5½; eye 3½.; interorbital width 4. D. 11; A. 12. Resembling *Argentina elongata*, but with a much deeper body, and a larger eye. Length of maxillary from tip of snout 4 in head, 1⅗ in snout. Snout but little longer than eye, 3⅙ in head; upper jaw with a narrow band of small teeth borne on the vomer and the front of the palatines, not on the very narrow weak premaxillaries; lower jaw toothless; edge of tongue with a series of strong, backwardly curved teeth, six or eight in number. Gill rakers numerous, slender, rather short, about 25 in number below angle of arch. Front of dorsal fin nearer tip of snout than base of caudal by a distance equaling diameter of pupil. Ventrals inserted behind middle of dorsal, midway between base of caudal and front of orbit, extending but little more than halfway to front of anal; caudal forked. Scales not spinous, the margins entire, a few only preserved along sides of tail; 40 or 45 in a longitudinal series. Eye, streak along sides and sides of head, silvery; occiput and snout dusky; a black blotch above each eye; fins somewhat dusky; mouth and gill cavity white; peritoneum black. Length 3 inches. Coast of California. One specimen known. (*sialis*, a word first used by Swainson to mean plump, from σιαλός, plump.)

*Argentina sialis*, GILBERT, Proc. U. S. Nat. Mus., 1890, 56, Albatross station 3017, in 58 fathoms. (Coll. Gilbert.)

### 799. ARGENTINA STRIATA, Goode & Bean.

Head 3 in total length; depth 7; eye 2½, longer than the conical snout. D. 10; A. 11; P. 17; V. 14. Ventrals nearly median, their insertion under the penultimate dorsal rays. Scales in lateral line obliquely striate. Tongue with teeth. Origin of dorsal equidistant between snout and root of caudal. There appears to have been a silvery, longitudinal band under the lateral line.

The specimens studied were denuded of scales, but the impressions indicate that there were 51 in the lateral line, 4 above and 4 below. The specimens (No. 43858, U. S. Nat. Mus.) were obtained by the *Albatross* from station 2402, in 28° 36′ N. latitude, 85° 33′ 30″ W. longitude, at a depth of 111 fathoms. (Goode & Bean.) (*striatus*, striate.)

*Argentina striata*, GOODE & BEAN, Oceanic Ichthyology, 52, fig. 62, 1895, Gulf Stream

### 244. LEUROGLOSSUS, Gilbert.

*Leuroglossus*, GILBERT, Proc. U. S. Nat. Mus., 1890, 57, (*stilbius*).

Appearance of *Argentina*, but the snout shorter, the maxillary reaching front of eye, and the tongue toothless. Ventrals under middle of dorsal. Mandible with a few weak teeth or none; premaxillaries toothless; a row of stronger teeth on vomer and front of palatines; tongue toothless. Pyloric cœca 9. Scales unknown, very caducous. One species known. (*λευρός*, smooth; *γλῶσσα*, tongue.)

#### 800. LEUROGLOSSUS STILBIUS, Gilbert.

Head 3; depth 5⅓. D. 10; A. 11. Snout 3¾ in head; interorbital width 4½. Eye 3⅕ in head, equaling maxillary, which reaches front of orbit. Body compressed, of moderate depth. Lower jaw projecting. Gill rakers long and numerous. Opercle very thin, membranous. Front of dorsal midway between base of caudal and front of pupil; ventrals inserted nearly under middle of dorsal, midway between base of caudal and preopercular margin; front of anal midway between base of caudal and base of ventrals. Scales wholly lacking in the two specimens obtained. Sides of head, body, and abdomen bright silvery; dorsal region dusted with fine black dots, which become coarser on tail. Snout blue-black; opercle with steely luster; upper part of eyeball black. Buccal and gill cavities, and peritoneum jet-black; fins dusky. Length 3 inches. Coast of California, in deep water. (*στιλβός*, shining.)

*Leuroglossus stilbius*, GILBERT, Proc. U. S. Nat. Mus., 1890, 57, from Albatross Stations 2997 and 2998, in 221 and 40 fathoms. (Type, No. 44283. Coll. Gilbert.)

### Family LXVII. MICROSTOMIDÆ.

Closely allied to the *Argentinidæ*, but with the branchiostegals reduced to 3 or 4; mouth very small, terminal, with small teeth, chiefly on the lower jaw and vomer. Gill membranes separate or united. Body elongate, subterete. Adipose fin present; dorsal short, posterior; ventrals behind middle of body. Three genera and about six species known, all from the deep waters of the Atlantic; reduced *Argentinidæ*.

MICROSTOMINÆ:
  *a.* Gill membranes separate; mouth very small; body subterete.
    *b.* Dorsal fin inserted before ventral. NANSENIA, 245.
BATHYLAGINÆ:
  *aa.* Gill membranes broadly united across the isthmus; body compressed; mouth small; eye very large; dorsal opposite ventrals. BATHYLAGUS, 246.

### 245. NANSENIA, Jordan & Evermann.

*Nansenia*, JORDAN & EVERMANN, new genus, (*grœnlandica*).

Body elongate, cylindrical, covered with large, thin, silvery scales. Head short. Mouth very small, terminal; premaxillaries very small; maxillaries very short and broad, not extending to the front of the very large eye, which forms more than half the depth of the side of the head. Lower jaw and vomer with a narrow series of fine teeth; no other teeth. Dorsal fin short, inserted mostly before the ventrals, which are behind the middle of the body; anal fin small; caudal small, forked, its central part scaly; pectoral rather narrow; adipose fin well developed in the young, but usually disappearing with age. Branchiostegals 3 or 4. Pseudobranchiæ well developed. Air bladder large, silvery. No pyloric cœca; mucous membrane of stomach papillose. Arctic Ocean; in deep waters. An imperfectly known genus, apparently distinguished from *Microstoma*, Cuvier, by the more anterior position of the dorsal, which is behind the ventrals in *Microstoma*, and apparently by the stouter body and the better development of the adipose fin. Most of the other characters above mentioned are drawn from *Microstoma* and have not been verified in *Nansenia*. (Named for our friend, Fridtjof Nansen (1861——), author of a study of the development of *Myxine*, and since noted as an intrepid arctic explorer.)

#### 801. NANSENIA GRŒNLANDICA (Reinhardt).

B. 3; D. 11; A. 10; V. 10. "This fish appears to be intermediate between *Argentina* and *Microstoma*, having the dorsal fin inserted for the greater part in advance of the ventrals, and a series of fine teeth in the lower jaw. Teeth on the vomer, none on the tongue. Adipose fin conspicuous. The height of the body is ½ the length of the head and $\frac{1}{10}$ of the total." (Günther, after Reinhardt.) Greenland.

*Microstomus grönlandicus*, REINHARDT, Vidensk. Selsk. Naturv. Mathem. Afhandl., VIII, 1841, LXXIV, Greenland; GÜNTHER, Cat., VI, 205, 1866; JORDAN & GILBERT, Synopsis, 290, 1883.

### 246. BATHYLAGUS, Günther.

*Bathylagus*, GÜNTHER, Ann. Mag. Nat. Hist., 1878, II, 248, (*atlanticus*).

Body oblong, compressed, covered with thin, deciduous scales of moderate size. Head short, compressed, the bones thin and membranaceous. Mouth very narrow, transverse, anterior. Maxillary very short, dilated, forming part of border of mouth. No luminous spots. Teeth in upper jaw rudimentary, those in lower jaw very small, on edge of bone forming a fine serrature; a series of minute teeth across vomer and along palatine. Eye very large. Pectorals and ventrals well developed, the ventrals with light rays, opposite dorsal, which is in middle of length of body; adipose fin small, near caudal; anal moderate or long. Gill opening narrowed, beginning opposite root of pectoral and extending across isthmus, the gill membranes united, free from isthmus. Gill rakers lanceolate, rather long; gills small. Pseudobranchiæ well developed. Deep seas, 5 species known.

"The thickness of the bones, the fragility of the fin rays, the delicacy of the skin and scales, and the enormously large eyes, seem to be sufficient evidence that these fishes are actually inhabitants of very great depths, although there may be reasonable doubts as regards the exact depth at which *Bathylagus atlanticus* was obtained. These fishes must, therefore, be entirely dependent for vision on the phosphorescent light which is produced by other abyssal creatures. Not being fish of prey themselves, or only to a slight degree, they would be attracted by the light issuing from the Pediculates and Stomiatids of the deep, and thus fall an easy prey to these fishes." (Günther.) (*βαθύς*, deep; *λαγῶς*, hare, from the big eyes.)

*a.* Depth of body about equal to length of head; scales about 32. D. 9; A. 19. BENEDICTI, 802.
*aa.* Depth of body much less than length of head.
  *b.* Interorbital space a little more than half eye; eye 2 in head. EURYOPS, 803.
  *bb.* Interorbital space ⅓ eye; eye 2¼ in head. PACIFICUS, 804.

### 802. BATHYLAGUS BENEDICTI, Goode & Bean.

Intermediate between *B. atlanticus* and *B. antarcticus*. Head 4½; depth 4½; eye 2, as in the other species. The width of the interorbital space is less than ⅔ of that of the eye (proportionately narrower than in the other species). Snout very short, 4 in eye. D. 9; A. 19; V. 9; P. 10. Mouth short, its angle being about on a level with lower margin of eye. Bones of head thin, semicartilaginous; head apparently scaleless; no traces of scales in the specimens before us. Gill cavity, membranes, and branchiostegals as in the other species. Origin of dorsal fin nearer end of snout than to base of caudal, and equidistant between snout and adipose fin, its length 2½ in head. Vent placed farther forward than in *B. atlanticus*, the length of the postanal portion of the body being greater than that of head, and contained 3½ times in the total without caudal; ventral fins opposite posterior portion of base of dorsal. Scales all lost; apparently in about 32 longitudinal rows; and their size may be judged by the fact that there were 7 rows between base of pectoral and vertical from origin of ventral. Adipose fin slender and long, 2 in eye.

Several specimens obtained by the Fish Commission steamer *Albatross*: One, 5¾ inches in length, from station 2094, at a depth of 1,022 fathoms; another, 5¾ inches in length, from station 2711, at a depth of 1,344 fathoms; a third specimen, about 4½ inches in length, from station 2572, at a depth of 1,769 fathoms. (Goode & Bean.) (Named for James E. Benedict, Asst. Curator of Invertebrates in the U. S. National Museum, for several years resident naturalist on the *Albatross*.)

*Bathylagus benedicti*, GOODE & BEAN, Oceanic Ichthyology, 55, fig. 64, 1895, Gulf Stream. (Type, No. 33510. Coll. Albatross.)

### 803. BATHYLAGUS EURYOPS, Goode & Bean.

Head 4; depth considerably less than length of head, equal to length of head without snout; eye 2. D. 9; A. 16; B. 7; P. 9. Width of interorbital space a little more than ½ eye. Snout very short; profile steep, its angle on a level with lower margin of eye. All the bones of the head very thin, semicartilaginous. Dorsal fin feeble, nearer tip of snout than root of caudal. Vent far back, the length of tail not being much more than that of head; anal feeble. Several specimens were obtained by the *Albatross* at about 40° N. latitude, 70° W. longitude, at a depth of 400 to 1,356 fathoms. (Goode & Bean.) (*εὐρύς*, wide; *ὤψ*, eye.)

*Bathylagus euryops*, GOODE & BEAN, Oceanic Ichthyology, 55, fig. 63, 1895, Gulf Stream. (Type, No. 35420, Coll. Albatross; and No. 31861, Coll. Fish Hawk.)

### 804. BATHYLAGUS PACIFICUS, Gilbert.

Head 4; depth 6⅔; eye 2¼. D. 8 or 9; A. 16; P. 9; scales 40. Anterior profile not decurved; premaxillaries anteriorly on level of middle of eye; snout short, less than half eye; interorbital space narrow, deeply grooved, ⅓ orbit; lower jaw with a series of small teeth; the very weak premaxillaries toothless; a strong series of teeth on vomer and palatines. Front of dorsal midway between adipose fin and front of snout; ventrals under posterior part of dorsal; anal far back; tail as long as head. Scales lost, apparently about 40 in lateral line. Head, lining of mouth, gill cavity, and peritoneum black; fins blackish; whole body probably black in life. Coast of Washington; two specimens taken in 685 and 877 fathoms.

*Bathylagus pacificus*, GILBERT, Proc. U. S. Nat. Mus., 1890, 55, Albatross Stations 3071 and 3074. (Coll. Gilbert.)

## Order T. INIOMI.*

### (THE LANTERN FISHES.)

Soft-rayed fishes, with the anterior vertebræ simple, unmodified, and without auditory ossicles; symplectic present; no interclavicles; opercular apparatus sometimes incomplete; pharyngeal bones unmodified; gill openings ample. Mesocoracoid arch wanting or atrophied.† Bones of jaws variously developed, the maxillary sometimes connate with the premaxillary. Shoulder girdle with its post-temporal not normally connected with the skull, but touching it at or near the nape. Gills 4, a slit behind the fourth. Air bladder, if present, with a duct. Dorsal and anal fins without true spines; ventral fins, if present, abdominal; scales mostly cycloid, often wanting; adipose fin present or absent. Skeleton mostly very weakly ossified. Photophores present in most cases.

Marine fishes, mostly inhabiting the oceanic abysses, closely allied to the *Isospondyli*, but lacking the mesocoracoid and having the connection of the shoulder girdle with the cranium imperfect. In the character of the mesocoracoid these fishes agree with the eels, and with the *Haplomi* and the spiny-rayed fishes. These latter have the post-temporal differently attached. This order is a provisional one, and its members may be reunited with the *Isospondyli* or otherwise distributed when the osteology of the different families is known. In but few genera has the mesocoracoid or the post-temporal received examination. (*ἰνίον*, nape; *ὦμος*, shoulder.)

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* We have had no opportunity for critical study of most of the families of the *Iniomi*. Our knowledge of them is drawn chiefly from the recent monographic works, especially the excellent report of Dr. Günther on the Deep-Sea Fishes of the Challenger Expedition, that of Dr. Vaillant on the fishes taken by the Travailleur et Talisman, and that of Dr. Lütken on the "Spolia Atlantica" in the museum at Copenhagen. Even more important than these has been the Oceanic Ichthyology of Goode & Bean, advance sheets of which comprehensive work have been most kindly placed at our disposal.

† This character, the most important by which the *Iniomi* are separated from *Isospondyli*, has not been verified in several of the families.

Günther divides the *Iniomi* into two families, *Stomiatidæ* and *Sternoptychidæ*, according to the relation of the maxillary to the border of the mouth. Goode and Bean follow Gill in separating the group into many families. Lütken, who has made most valuable studies among the deep-sea forms, seems inclined to recognize several families. He regards it as necessary either freely to subdivide the group or else to regard the whole as a single family. The composition of the group and the varied relations of its parts are best seen by regarding its principal types as of family value. We begin the series with the family which contains most shore species, and which is apparently nearest the *Isospondyli*, from which group the *Iniomi* have apparently been modified or degraded.

## Families* of INIOMI.

- *a.* Post-temporal connected with back of cranium near sides; no photophores or barbel.
  - *b.* Adipose fin typically present (rarely atrophied or lost); body not very elongate; anal fin distinct.
    - *c.* Scales present, usually persistent; teeth cardiform or villiform, usually movable.
      - *d.* Maxillary very narrow, rudimentary, or obsolete; hypocoracoids not divergent; pseudobranchiæ present. SYNODONTIDÆ, LXVIII.
      - *dd.* Maxillary well developed, dilated behind.
        - *e.* Pseudobranchiæ present; pectorals normal; hypocoracoids mostly divergent, undivided. AULOPIDÆ, LXIX.
        - *ee.* Pseudobranchiæ absent; pectorals not normal.
          - *f.* Pectorals subhumeral. BENTHOSAURIDÆ, LXX.
          - *ff.* Pectoral rays elongate, arranged in two groups. BATHYPTEROIDÆ, LXXI.
  - *bb.* Adipose fin absent.
    - *g.* Body covered with scales which are large, thin, and deciduous; teeth villiform, in bands; no photophores on the scales, but a large, luminous plate on the head in place of eyes; maxillary dilated behind; pectorals and ventrals well developed, approximate. IPNOPIDÆ, LXXII.
    - *gg.* Body scaleless; teeth granular, in bands; pectorals normal.
      - *h.* Ventrals present; opercular apparatus incomplete. RONDELETIIDÆ, LXXIII.
      - *hh.* Ventrals absent; opercular apparatus complete; a conspicuous lateral furrow; general form and appearance of young cetaceans. CETOMIMIDÆ, LXXIV.
- *aa.* Post-temporal impinging upon occiput.
  - *i.* Vertebræ and neural spines normal, not projecting from the flesh in front of the dorsal fin.
    - *j.* Photophores present.
      - *k.* Barbel wanting.
        - *l.* Pseudobranchiæ present.
          - *m.* Premaxillaries forming entire margin of upper jaw; body scaly; opercles complete. MYCTOPHIDÆ, LXXV.
          - *mm.* Premaxillaries not forming the whole margin of upper jaw, the maxillary entering into it; body naked; opercular apparatus incomplete. MAUROLICIDÆ, LXXVI.
        - *ll.* Pseudobranchiæ absent; mouth large, with canine teeth; scales deciduous or wanting. CHAULIODONTIDÆ, LXXVII.
      - *kk.* Barbel present, very long.

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* The analysis of the families of *Iniomi* is chiefly taken from Goode & Bean, Oceanic Ichthyology.

*n.* Maxillaries forming lateral margin of upper jaw; barbel free at tip.

*o.* Adipose fin present; pectorals present; body naked; dorsal behind vent, but in advance of anal. ASTRONESTHIDÆ, LXXVIII.

*oo.* Adipose fin absent; pectorals present or absent. STOMIATIDÆ, LXXIX.

*nn.* Maxillaries not forming part of margin of upper jaw; pectorals rudimentary; opercles membranaceous; body scaleless; dorsal short, postmedian; barbel of peculiar form, connecting throat with symphysis of lower jaw. MALACOSTEIDÆ, LXXX.

*jj.* Photophores minute or wanting; no barbel.

*p.* Premaxillaries forming margin of upper jaw; fang-like teeth in mandibles and palatines and sometimes on vomer.

*q.* Dorsal long, occupying entire back; body naked. ALEPISAURIDÆ, LXXXI.

*qq.* Dorsal short, median or posterior.

*r.* Body naked. ODONTOSTOMIDÆ, LXXXII.

*rr.* Body covered with thin, caducous scales. PARALEPIDIDÆ, LXXXIII.

*ii.* Vertebral or neural spines projecting through skin of the back in front of dorsal fin.

*s.* Body short and deep, compressed; anterior neural spines abnormally developed, projecting through the skin of the back, in advance of the dorsal; pectorals present; photophores present; mouth obliquely cleft or subvertical. STERNOPTYCHIDÆ, LXXXIV.

*ss.* Body elongate, snake-like; vertebræ with spiny processes anteriorly which project through the skin of the back in front of dorsal rays; pectorals absent; body naked; dorsal long and low, beginning in advance of the vent. IDIACANTHIDÆ, LXXXV.

## Family LXVIII. SYNODONTIDÆ.

### (THE LIZARD FISHES.)

Body oblong or elongate, little compressed, covered with cycloid scales, rarely naked. Mouth very wide, the entire margin of the upper jaw formed by the long and slender premaxillaries, closely adherent to which are the slender maxillaries, the latter mostly rudimental or obsolete, never widened at tip. Teeth mostly cardiform on both jaws, tongue, and palatines; canines rarely present; large teeth usually depressible. No barbels. Opercular bones usually thin, but complete. Gill membranes separate, free from the isthmus. Branchiostegals usually numerous. Pseudobranchiæ present. Gill rakers tubercular or obsolete. Lateral line present. Adipose fin present, rarely obsolete; dorsal fin short, of soft rays only; pectorals and ventrals present; anal fin moderate or long; caudal forked. Skeleton rather well ossified. Air bladder small or wanting. Intestinal canal short. Sides sometimes with phosphorescent spots or photophores. Eggs inclosed in the sacs of the ovary and extruded through an oviduct. Genera about 10, species about 40, mostly inhabiting shore waters, some of them descending to the depths. (*Scopelidæ*, group *Saurina*, part, Günther, Cat., v, 393–403, 1864.)

*a.* Scales present, more or less adherent.

*b.* Teeth of premaxillary simple, compressed, not barbed, in one or two rows; a broad band of similar teeth on palate.

*c.* Vent slightly nearer base of caudal than axil of pectoral; head short, blunt, compressed. TRACHINOCEPHALUS, 247.

*cc.* Vent much nearer base of caudal than base of ventrals; head depressed, with flat triangular snout. SYNODUS, 248.

*bb.* Teeth of premaxillary in a very broad band, curved, unequal, and barbed at the end; a similar band on palatines. BATHYSAURUS, 249.

*aa.* Scales very caducous or wanting; teeth in narrow bands; vent posterior. BATHYLACO, 250.

## 247. TRACHINOCEPHALUS, Gill.

*Trachinocephalus*, GILL, Cat. Fish. East Coast N. Amer., 53, 1851, (*myops*). (Name only; first defined by JORDAN & GILBERT, Synopsis, 281, 1883.)

This genus is closely related to *Synodus*, from which it differs chiefly in form and in the relative development of the fins. Body stout, the head short, blunt, and compressed, its form much as in the genus *Trachinus*. Vent well formed, very slightly nearer base of caudal than base of ventrals, under tip of last dorsal ray. Teeth as in *Synodus*, but slender, smaller, and closely set. Lower jaw projecting. Species few, shore fishes, widely diffused in the tropical seas. (*Trachinus*, the weaver-fish, connected with *δράκαινα*, dragon, the name still used in Greece; *κεφαλή*, head.)

### 805. TRACHINOCEPHALUS MYOPS (Forster).

(GROUND SPEARING; LAGARTO.)

Head 3⅔; depth about 5. D. 11; A. 14 or 15; scales 4–58–7. Vertebræ 58; cœca 25. Snout very short, shorter than eye, lower jaw projecting; top of head rough; interorbital space concave. Pectoral very short, nearly 2 in head, scarcely reaching beyond the front of the very long ventrals, which are as long as head and reach vent; anal very large, its base 1¼ in head, ¼ longer than the dorsal. Light brown; three or more lengthwise stripes of yellowish alternating with brown, the upper stripe just above lateral line and edged with darker; a pale streak along lateral line; six diffuse brown cross blotches on back, ceasing just below lateral line; back mottled, a large black scapular blotch; top of head vermiculated; a dark brown band from eye across lower jaw; fins nearly plain. Tropical parts of the western Atlantic, abundant and widely diffused; common in West Indies and Brazil, and ranging on our Atlantic Coast to South Carolina; originally described from St. Helena. (*μύωψ*, short-sighted, blinking.)

*Salmo myops*, FORSTER MS., BLOCH & SCHNEIDER, Syst. Ichth., 421, 1801, St. Helena.
*Osmerus lemniscatus*, LACÉPÈDE, Hist. Nat. Poiss., v, 236, 1803, Martinique; after Plumier.
*Saurus truncatus*, AGASSIZ, Pisc. Brasil., 82, 1828, Brazil.
*? Salmo trachinus*, SCHEGEL, Fauna Japon. Poiss., 231, 1842, Japan; the East Indian, Chinese, and Japanese form, *Trachinocephalus limbatus*, is little if at all different from *T. myops*.
*? Saurus limbatus*, EYDOUX & SOULEYET, Voyage Bonite, Poiss., 199, 1853.
*Saurus brevirostris*, POEY, Memorias, II, 305, 1861, Cuba; erroneously stated to have 10 rays.
*Saurus myops*, GÜNTHER, Cat., v, 398, 1864.
*Synodus myops*, JORDAN & GILBERT, Synopsis, 281, 1883.
*Trachinocephalus myops*, JORDAN, Proc. U. S. Nat. Mus., 1890, 314.

## 248. SYNODUS* (Gronow) Bloch & Schneider.

(LIZARD FISHES.)

*Synodus* (GRONOW) BLOCH & SCHNEIDER, Syst. Ichth., 396, 1801, (*synodus*).
*Tirus*, RAFINESQUE, Caratteri, etc., 56, 1810, (*marmoratus*).
*Saurus*, CUVIER, Règne Animal, Ed. I, 169, 1817, (*saurus*).
*Alpismaris*, RISSO, Eur. Mérid., III, 458, 1826 (*Alpismaris risso*), (very young).
*Laurida* (ARISTOTLE) SWAINSON, Nat. Hist. Anim., II, 287, 1839, (*mediterraneus* = *saurus*).

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* The species of *Synodus* have been critically studied by Dr. Seth E. Meek, Proc. Ac. Nat. Sci. Phila. for 1884.

First superior pharyngeal cartilaginous; second without teeth; third and fourth separate, with teeth; lower pharyngeals separate. Body elongate, subterete. Head depressed, the snout triangular, rather pointed. Interorbital region transversely concave. Mouth very wide; premaxillaries not protractile, very long and strong, more than half length of head; maxillaries closely connected with them, very small or obsolete; premaxillaries with one or two series of large, compressed, knife-shaped teeth, the inner and larger depressible; palatine teeth similar, smaller, in a single broad band; lower jaw with a band of rather large teeth, the inner and larger teeth depressible; a patch of strong, depressible teeth on the tongue in front, and a long row along the hyoid bone; jaws nearly equal in front. Eye rather large, anterior; supraorbital forming a projection above the eye. Pseudobranchiæ well developed. Gill rakers very small, spine-like. Gill membranes slightly connected. Top of head naked; cheeks and opercles scaled like the body; body covered with rather small, adherent, cycloid scales; lateral line present; no luminous spots. Dorsal fin short, rather anterior; pectorals moderate, inserted high; ventrals anterior, not far behind pectorals, large, the inner rays longer than the outer; anal short; caudal narrow, forked. Vent posterior, much nearer base of caudal than base of ventrals. Branchiostegals 12 to 16. Stomach with a long, blind sac and many pyloric cœca. Skeleton rather firm. Species numerous. Voracious fishes of moderate size, inhabiting sandy bottoms at no great depth, in most warm seas. (*συνόδους*, ancient name of some fish, from *συνόδους*, teeth meeting, not shutting past each other like scissors.)

*a.* Scales large, 43 to 50 in the lateral line, which has a blunt keel posteriorly.
  *b.* Tips of first rays of dorsal not reaching tips of last rays when depressed; snout short, broad, $4\frac{1}{2}$ in head; shoulder girdle with a large black blotch, anal rays 10 or 11;[*] scales 4–48–6. INTERMEDIUS, 806.
  *bb.* Tips of first rays of dorsal reaching tips of last rays when depressed.
    *c.* Shoulder girdle chiefly black; snout short, rounded, 4 in head; ventrals $1\frac{3}{5}$ in head; anal rays 10; scales 4–48–5. EVERMANNI, 807.
    *cc.* Shoulder girdle with the black spot very small or wanting; snout rather pointed, $3\frac{3}{4}$ in head; ventrals $1\frac{1}{4}$ in head; anal rays 10 to 12. POEYI, 808.
*aa.* Scales small, 58 to 68 in lateral line.
  *d.* Anal fin very short, its rays 8 only; pectoral fin short.
    *e.* Scales moderate, 58 in the lateral line; snout 4 in head; shoulder girdle slightly dusky; dorsal mottled. SYNODUS, 809.
    *ee.* Scales small, 68 in the lateral line; snout $4\frac{1}{3}$ in head; shoulder girdle pale; dorsal mottled. LACERTINUS, 810.
  *dd.* Anal fin moderate, its rays 10 to 13; shoulder girdle chiefly yellowish.
    *f.* Snout very broad, broader than long; about 10 scales in a cross series from dorsal to ventral; jaws subequal; scales 4–60 to 64–5; tail with a slight keel. SAURUS, 811.
    *ff.* Snout not broader than long; more than 10 scales in a cross series from dorsal to ventral; lower jaw included; tail not keeled.
      *g.* About 4 rows of scales (6 counting obliquely) between lateral line and adipose fin; scales on cheeks in 4 to 7 rows.
        *h.* Head very small, $4\frac{1}{2}$ to $4\frac{3}{5}$ in length; first ray of dorsal coterminous with last ray when the fin is depressed; cheeks with 4 rows of large scales; ventrals $1\frac{1}{7}$ in head. Scales 6–61–6. SCITULICEPS, 812.

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[*] In the count of rays in the species of *Synodus*, only those fully developed are enumerated, the rudimentary simple ray being omitted.

*hh.* Head moderate, 3¾ to 4¼ in length; scales on cheeks in 6 or 7 rows.
  *i.* Head not vermiculate above, its length 3¾ to 4 in body; 6 rows of scales on cheeks. JENKINSI, 813.
  *ii.* Head vermiculate above, its length 4 to 4¼ in body; 7 rows of scales on cheeks. FŒTENS, 814.
*gg.* About 6 rows of scales in a vertical row between lateral line and adipose fin; cheeks with 9 rows of scales; scales 13–66–16, the vertical rows counted obliquely. LUCIOCEPS, 815.

### 806. SYNODUS INTERMEDIUS (Agassiz).

(SAND DIVER.)

Head 4; depth 8; eye 4½. D. 11; A. 11; scales 4–48–7. Body rather stout; head blunt, large, the snout broader than long, about equal to eye. Frontal bones little striate; interorbital space concave, 6 in head; prominent striæ behind eye; jaws subequal; premaxillary 1⅔ in head, longer than pectoral. Scales large, 4 to 6 rows on cheeks, 3 series between adipose fin and lateral line. Dorsal high, as high as long; pectoral 2 in head; ventral 1⅙. Grayish, abruptly paler below; back and sides with 8 dark crossbands broadest at lateral line, these sometimes alternating with fainter ones; a large jet-black blotch on upper part of shoulder girdle, hidden by opercle; membrane of maxillary black; dorsal and pectorals finely barred; lower fins and branchiostegals yellow; adult with an orange spot on each scale below. Length 15 inches. Coast of southern Florida to Brazil; not rare; the most brightly colored of our species. (*intermedius*, intermediate—between *myops* and *fœtens*.)

*Saurus intermedius*, AGASSIZ, Spix, Pisc. Brasil., 81, 1828, Brazil.
*Saurus anolis*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XXII, 483, 1849, Bahia; Martinique.
*Saurus intermedius*, GÜNTHER, Cat., v, 396, 1864.
*Synodus intermedius*, JORDAN & GILBERT, Synopsis, 889, 1883.

### 807. SYNODUS EVERMANNI, Jordan & Bollman.

Head 3⅓ to 3¾; depth 6½ to 7. D. 10; A. 10; scales 4–47 to 49–5. Body terete, rather robust; snout short, rounded rather than pointed, 4 in head. Mouth large; maxillary 1¾ in head. Lower jaw barely projecting. Interorbital area concave, rugose, its least width 5⅖ in head; supraorbital ridge prominent, finely striate. Origin of dorsal nearer adipose fin than snout by ¾ width of interorbital area; anterior rays of dorsal coterminous with posterior when depressed, the last rays not filamentous; the free edge of the fin little concave; dorsal fin higher than long by nearly an eye's diameter, its length 2⅕ in head; tip of ventrals reaching halfway to vent (farther in young); their length 1⅗–1⅘ in head; pectorals extending to near middle of ventrals, 1⅗–1⅘ in head; lobes of caudal equal. Lateral line with a blunt keel. Color dark above; 8 to 10 dusky greenish oblong spots along lateral line, between which and below lateral line are traces of smaller spots; a dusky shade over opercle; skin lining opercle and shoulder girdle dark, the black markings surrounded by yellow; adipose fin dark, edged with pale; caudal not barred, inner rays dusky; pectorals and dorsal somewhat dusky; other fins pale; tip of chin scarcely dusky. Mazatlan to coast of Colombia; abundant. Length 8 inches. (Named for Dr. Barton Warren Evermann, Ichthyologist of the United States Fish Commission.).

*Synodus evermanni*, JORDAN & BOLLMAN, Proc. U. S. Nat. Mus., 1889, 152, Pacific Ocean, off coast of Colombia, in 33 fathoms. (Type, No. 41144. Coll. Albatross.)

### 808. SYNODUS POEYI, Jordan.

Head 4; depth 6¾. D. 10; A. 10 to 12; scales 4–44–4. Body terete, rather robust, the snout rather long and pointed, 3¾ in head; mouth large, the premaxillary 1¾ in head; lower jaw slightly projecting; interorbital area concave; supraorbital ridge present. Dorsal fin inserted midway between tip of snout and front of adipose fin; the tips of first and last rays equal when the fin is deflexed. Ventrals 1¼ in head, reaching ⅗ distance to vent; pectorals reaching base of ventrals, 1⅘ in head. Lateral line with a slight keel posteriorly. Yellowish above, scales punctate with dark; breast flesh-colored; sides with a row of irregular black markings; scapula barred with black, occasionally with a small black spot, fins not barred, the caudal with dusky shades. Length 5 inches. Cuba; abundant. (Named for Prof. Felipe Poey, its discoverer.)

*Synodus intermedius*, POEY, Enumeratio, 175, 143, 1875; not of AGASSIZ; MEEK, Proc. Ac. Nat. Sci. Phila., 1884, 133.

*Synodus poeyi*, JORDAN, Proc. U. S. Nat. Mus., 1886, 526, Havana. (Coll. Jordan.)

### 809. SYNODUS SYNODUS (Linnæus).

Head 3½; depth 5; eye 5⅔ in head; snout 4; premaxillary 1⅗; pectoral 2¼; ventral $1\frac{1}{10}$; anal very short. D. 11; A. 8; scales 5 or 6–58–8. Top of head quite warty, marked with radiating and with cross streaks of warts; interorbital space concave, marked with small warts; supraorbital with a conspicuous bony ridge. Palatine teeth long and slender, slenderer than teeth of the jaw and almost in one series. Body much mottled and vermiculated with darker, and crossed by about 15 dark half bands; scapular region dusky but without distinct spot; dorsal and anal mottled, other fins plain. Coast of Brazil and Lesser Antilles, its distribution imperfectly known; our description taken from two specimens in the museum at Paris from Bahia, types of the description of Cuvier & Valenciennes. The species may not be the original *Synodus* of Gronow and Linnæus. No other specific name seems, however, ever to have been given to it.

? *Esox synodus*, LINNÆUS, Syst. Nat., Ed. XII, 516, 1766, America; based on *Synodus* of GRONOW

*Saurus synodus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XXII, 477, 1849.

? *Synodus fasciatus*, LACÉPÈDE, Hist. Nat. Poiss., V, 321, 1804; after GRONOW.

? *Saurus varius*, GÜNTHER, Cat., V, 395, 1864; the true *varius* is a closely related species, possibly identical with *S. synodus*, representing the latter in the Western Pacific; its scales, 60 to 64, appear smaller than in *S. synodus*.

### 810. SYNODUS LACERTINUS, Gilbert.

Head 3⅘; depth 5⅔; eye 6. D. 11; A. 8; scales 68. Snout short, 4⅓ in head, 2¾ in premaxillary, its length slightly less than its width at base. Eye over middle of premaxillary, which is 1¾ in head; interorbital width half snout; occiput with well-developed rugosites. Scales on cheeks crowded, in 6 rows; four series between adipose fin and lateral line. Front of dorsal nearer tip of snout than adipose fin by a distance equaling diameter of pupil; the fin low, the tips of anterior rays barely reaching base of posterior ray in reflexed fin; base of dorsal $1\frac{7}{9}$ in head; upper outline of dorsal convex; anal very small, its base $\frac{1}{3}$ length of head; pectorals very short, bluntly rounded, the longest ray $2\frac{1}{2}$ in head, not reaching beyond vertical from base of ventrals; ventrals reaching halfway to front anal, $1\frac{1}{7}$ in head. Color black, with 5 broad dark bars reaching to lateral line or below; the middle of each interspace with a fainter bar confined to back; mandible below with alternating brown and silvery crossbars; a black spot at lower angle of cheeks, with a small silvery blotch below it; inside of mouth and gill cavity pale; dorsal and caudal faintly barred. Length $6\frac{1}{4}$ inches. Acapulco, Mexico; one specimen known. (*lacertinus*, lizard-like.)

*Synodus lacertinus*, Gilbert, Proc. U. S. Nat. Mus., 1890, 55, Acapulco. (Type, No. 44300. Coll. Albatross.)

### 811. SYNODUS SAURUS (Linnæus).

(Tarentola; Lacerto; Tiru.)

Head 4; B. 15; D. 12; A. 12. Scales 3 or 4–60–2. Snout broader than long, the jaws subequal; teeth small; upper surface of head corrugated. Dorsal slightly higher than long, the tips of the first rays not extending beyond tips of last; pectoral reaching ninth or tenth scale of lateral line. Scales on tail faintly keeled. Dusky gray, yellow below. Length 17 inches. (Günther; Goode.) Coasts of Southern Europe and neighboring islands, recorded by Dr. Goode from the Bermudas. (σαῦρος, lizard.) (Eu.)

*Salmo saurus*, Linnæus, Syst. Nat., Ed. xii, 511, 1766, Mediterranean; after Artedi.
*Saurus griseus*, Lowe, Trans. Zoöl. Soc., ii, 1841, 188, Madeira; Günther, Cat., v, 394, 1864.
*Laurida mediterranea*, Swainson, Nat. Hist. Anim., ii, 287, 1839, Mediterranean; name only.
*Tirus marmoratus*, Rafinesque, Caratteri, 56, 1810, Palermo.
*Alpismaris risso*, Risso, Eur. Mérid., iii, 458, 1826, Nice; very young.
*Synodus lacerta*, Goode, Bull. U. S. Nat. Mus., v, 1876, 68, Bermuda specimen; not of Risso.

### 812. SYNODUS SCITULICEPS, Jordan & Gilbert.

Head $4\frac{3}{5}$; depth $6\frac{2}{3}$. D. 10; A. 12; scales 6–61–6. Allied to *S. fœtens*, but with the head very small; cheeks with about 4 rows of large scales; opercles with 4; 4 rows between adipose fin and lateral line; ventrals $1\frac{1}{7}$ in head; pectoral 2. Coloration brownish olive, scales of back with pale dashes; head marbled above; pectoral and caudal blackish; adipose fin black, edge pale; no yellow. Length 7 inches. Cape San Lucas to Panama; not uncommon in shallow bays. (*scitulus*, slender; *-ceps*, head.)

*Synodus scituliceps*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1881, 344, Mazatlan. (Type, No. 28392. Coll. Gilbert.)

### 813. SYNODUS JENKINSI, Jordan & Bollman.

Head $3\frac{3}{4}$ to 4; depth $6\frac{4}{5}$ to 7. D. 10 or 11; A. 13; scales 5–62 to 65–6, 6 rows on cheeks. Body slender, subterete, depressed. Head moderate, much larger than in *S. scituliceps.* Snout broadly triangular, little pointed, 3⅓ in head, its length about equal to its breadth at base. Mouth large, premaxillary 1⅔ in head. Interorbital area concave, rugose, slightly broader than eye, 5½ in head; supraorbital finely striate, with serrulate edge. Lower jaw included; teeth moderate. Lateral line without keel. Origin of dorsal midway between adipose fin and anterior margin of pupil; anterior rays of dorsal not extending so far as the last when depressed; tip of ventrals reaching slightly more than halfway to vent, their length $1\frac{3}{7}$ in head; pectorals reaching root of ventrals, 2 in head, and longer than snout and eye in larger specimens. Color brownish olive; scales on back with paler specks; a few rows of scales below lateral line with numerous black dots; head not marbled; jaws not spotted, tip of lower black; inside of opercles dark; lining of shoulder girdle yellow; pectorals and caudal dusky, former tipped with pale; adipose fin dark, margined with paler; lower fins pale. Gulf of California to Galapagos Islands, in 16 to 33 fathoms; common. (Named for Dr. Oliver Peebles Jenkins, who obtained the species at Guaymas.)

*Synodus jenkinsi*, Jordan & Bollman, Proc. U. S. Nat. Mus., 1889, 153, off coast of Colombia, Galapagos Islands. (Type, No. 41171. Coll. Albatross).

### 814. SYNODUS FŒTENS (Linnæus).

(Lizard Fish; Galliwasp; Lagarto; Soapfish.)

Head 4¼; depth 7; eye 5½. D. 9 or 10; A. 11 or 12; V. 8; scales 7–60 to 64–8 (the vertical rows counted obliquely). Snout long, the upper jaw 1½ in head. Scales less regularly arranged, and the rows less oblique than in *Synodus lucioceps*; those on the opercle in about 5 rows, on the cheeks in 7; 25 to 30 scales along back before dorsal, 4 in a vertical row between adipose fin and lateral line, 5 in an oblique row. Pectoral fin short, 2 in head, not reaching ventrals, its length ¾ that of the premaxillary; ventral large, 1¼ in head, its length from outer edge of base greater than from tip of snout to upper edge of gill opening. Interorbital space considerably concave, with radiating ridges. Olivaceous or sandy gray; yellowish below; back mottled; upper surface of head brownish, distinctly vermiculated with yellowish; ventral fins, lower side of head, and inside of mouth tinged with yellow; no scapular spot; snout not black at tip; dorsal scarcely barred. Length 12 inches. Cape Cod to Brazil, very common from South Carolina southward, on sandy coasts; not valued as food. (*fœtens*, odorous.)

*Salmo fœtens*, Linnæus, Syst. Nat., Ed. xii, 513, 1766, South Carolina. (Coll. Dr. Garden.)
*Osmerus albidus*, Lacépède, Hist. Nat. Poiss., v, 229, 1803, Carolina; after Linnæus.
*Coregonus ruber*, Lacépède, Hist. Nat. Poiss., v, 263, 1803, Martinique; after Plumier.
*Esox salmoneus*, Mitchill, Trans. Lit. & Phil. Soc., i, 1815, 442, New York.
*Saurus longirostris*, Agassiz, Spix. Pisc. Brasil. pl. 43, 1828, Brazil.
*Saurus mexicanus*, Cuvier, Règne Animal, Ed. ii, 314, 1829, Mexico.
*Saurus spixianus*, Poey, Memorias, ii, 304, 1861, Cuba.
*Saurus fœtens*, Günther, Cat., v, 396, 1864; Holbrook, Ichth. S. Car., 187, 1860.
*Synodus spixianus*, Poey, Enumeratio, 141, 1875; Jordan, Proc. U. S. Nat. Mus., 1884, 107.
*Synodus fœtens*, Jordan & Gilbert, Synopsis, 280, 1883.
*Synodus fœtens* and *spixianus*, Meek, Proc. Ac. Nat. Sci. Phila., 1884, 135.

### 815. SYNODUS LUCIOCEPS (Ayres).

Head 4; depth 8¼; eye 5. D. 11; A. 12; B. 14; scales 13–66–16 (the vertical series counted obliquely). Scales arranged in regular, very oblique rows; those on the opercles in about 8, on the cheeks in about 9, rows; 40 to 50 scales along the back before the dorsal, 6 in a vertical row between adipose fin and lateral line, and 10 in an oblique row. Pectoral fin longer, reaching base of ventrals, its length about equal to that of the premaxillary; ventral fin not so long as the space between snout and upper edge of gill opening. Interorbital space little concave, nearly smooth. Olive-brown above, grayish below, with some golden luster on sides; back with slaty reticulations; head not vermiculated above; lower side of head and ventral fins yellow. Length 18 inches, but usually much smaller. San Francisco to Santa Barbara, rather common in summer; resembles *S. fœtens*, but the scales are smaller. (*lucius*, pike; *-ceps*, head.)

*Saurus lucioceps*, AYRES, Proc. Cal. Ac. Sci., 1855, 66, San Francisco; GÜNTHER, Cat., v, 397, 1864.
*Synodus lucioceps*, JORDAN & GILBERT, Synopsis, 281, 1883.

## 249. BATHYSAURUS, Günther.

*Bathysaurus*, GÜNTHER, Ann. Mag. Nat. Hist., August, 1878, 181, (*ferox*).

Body formed as in *Synodus*, subcylindrical, elongate, covered with small scales. Head depressed, with the snout produced, flat above. Cleft of the mouth very wide, with the lower jaw projecting; premaxillary very long, styliform, tapering, not movable; maxillary obsolete. Teeth in the jaws in broad bands, not covered by lips, curved, unequal in size, and barbed at the end; a series of similar teeth along the whole length of each side of the palate; a few teeth on the tongue, and groups of small teeth on the hyoid; eye moderate, lateral. Pectoral moderate; ventrals eight-rayed, inserted close behind pectoral; dorsal fin median, of about 18 rays; adipose fin present or absent; anal moderate; caudal emarginate. Gill openings very wide, the gill membranes separate, free from the isthmus. Branchiostegals 11 or 12. Gill laminæ well developed; gill rakers tubercular; pseudobranchiæ well developed. Scales rather small. Deep-sea fishes. (*βαθύς*, deep; *σαῦρος*, *Saurus* = *Synodus*.)

### 816. BATHYSAURUS FEROX, Günther.

Head 3½; depth 7. B. 10; D. 17 or 18; A. 11; C. 19; P. 15; A. 8; scales 8–74 to 78–8. Body elongate, subterete. Head alligator-like, naked, except on cheek and occiput, with strong nasal and interorbital ridges; its greatest width more than half its length; gape of mouth very wide, ⅙ length of body, extending behind eye for a distance equal to interorbital width. Premaxillary with 2 irregular rows of depressible teeth, some of them barbed, those of inner row much the largest; lower jaw enormously strong, its sides projecting beyond the upper jaw; its dentary edge thickly studded with depressible teeth, many of them, especially the larger inner ones, strongly barbed; those in front, claw-like, recurved; 3 rows of teeth on the palatines, the middle ones very much enlarged and most of them strongly barbed, these being the largest of all the teeth; on the tongue a few weaker teeth and groups of similar teeth on the vomer. Insertion of dorsal behind snout at a distance a little more than its own base and about ⅓ the total length, longest ray equal to greatest depth of body. No adipose dorsal (in the specimens known); anal inserted considerably behind last ray of dorsal, its base about half that of the dorsal; ventrals well apart, inserted just in front of the dorsal, their length half head; pectoral as long as lower jaw, its seventh ray prolonged to a length equal to that of head; caudal slightly forked; scales thin, cycloid, deciduous, those of the lateral line larger, brownish; lining of gill cavity blue-black. Atlantic and South Pacific, known from off New Zealand, Morocco, and the Gulf Stream if, as supposed, the American *B. agassizii* is identical with *B. ferox*. (Goode & Bean.) (*ferox*, ferocious.)

*Bathysaurus ferox*, Günther, Ann. Mag. Nat. Hist., 1878, 182, east coast of New Zealand.

*Bathysaurus agassizii*, Goode & Bean, Bull. Mus. Comp. Zoöl., 1882, 215, Gulf Stream, 33° N. in 647 fathoms; Goode & Bean, Oceanic Ichth., 58, 1895.

## 250. BATHYLACO, Goode & Bean.

*Bathylaco*, Goode & Bean, Oceanic Ichthyology, 57, 1895, (*nigricans*).

Body subcylindrical, rather elongate, stout, similar in form to *Synodus*. (Scales absent in the specimen studied, and it is not even possible to determine whether or not this is a naked species.) Head conical; snout short. Mouth very large, wide, oblique, lower jaw slightly projecting. Premaxillary narrow and long, with small teeth, which are somewhat biserial in front and uniserial behind, interrupted at the symphysis. Mandible with a narrow band of similar teeth; palatine teeth in a narrow band; tongue toothless. Eye moderately large, very far forward, its upper edge close to the dorsal profile. Pectoral small, placed low; ventral nearly median, a little in advance of the dorsal and far behind the pectoral, with 8 rays; dorsal origin nearly in the middle of the length and extending to above the middle of the anal; adipose fin probably absent; anal origin far back, fin short. Gill opening very wide, as in *Bathysaurus*, the left membrane overlapping the right, not attached to the isthmus. Branchiostegals numerous. Gill rakers short and few. Opercular bones very thin and feeble. Deep sea. (βαθύς, deep; λάκωος, a hole or pit.)

### 817. BATHYLACO NIGRICANS, Goode & Bean.

Head 4; depth 2; eye 4⅓ in head, equal to interorbital width. B. 8; D. 20; A. 10; V. 8; P. 6. Snout about 2 in eye and about 8 in head. The lower jaw the longer. The intermaxillary is nearly ⅔ length of head. The mandible is contained 3 times in distance from tip of snout to origin of dorsal; dorsal fin inserted at a distance from the tip of the snout equal to twice length of head, the length of its base nearly ⅓ of total (without caudal); origin of anal under posterior third of dorsal, the length of its base equal to half that of head; pectoral small, placed low, immediately back of the branchial opening; apparently few-rayed. Color black.

A single specimen in very bad condition, 8½ inches in length, taken by the *Blake* off Santa Cruz, at a depth of 2,393 fathoms. (Goode & Bean.) (*nigricans*, blackish.)

*Bathylaco nigricans*, Goode & Bean, Oceanic Ichthyology, 57, fig. 69, 1895, off Santa Cruz, Mexico.

## Family LXIX. AULOPIDÆ.

Allied to the *Synodontidæ*, but with the maxillary separate, well developed, and dilated behind. Hypocoracoids extended downward as in many spiny-rayed fishes. Gill rakers mostly long and slender, needle-shaped. Eyes normal, large or small. No luminous spots; jaws without fang-like teeth. Dorsal fin moderate, nearly median in position, the body elongate. Pectorals present, normal in form and position; adipose fin normally present. Pseudobranchiæ present. This family as here understood includes some half dozen species—fishes of moderate depths, chiefly of the Atlantic.

*a.* Dorsal fin moderate, of less than 15 rays; teeth minute; scales ctenoid; gill rakers very slender. CHLOROPHTHALMUS, 251.

### 251. CHLOROPHTHALMUS, Bonaparte.

*Chlorophthalmus*, BONAPARTE, Fauna Italica, fasc. XXVIII, Pesci, 1840, (*agassizii*).
*Hyphalonedrus*, GOODE, Proc. U. S. Nat. Mus., III, 1880, 483, (*chalybeius*).

Head elongate; body subterete, covered with moderate-sized, adherent, pectinate, or ctenoid scales, which are arranged in straight, parallel, oblique lines. Mouth rather large, the maxillary well developed, dilated behind, reaching to beyond front of orbit; lower jaw projecting. Teeth very small, sharp on jaws, vomer, and palatines, usually minute teeth on tongue; eye very large. Dorsal short, inserted before middle of length of body; adipose fin small; anal short; caudal forked; pectorals and ventrals well developed, the ventrals inserted under dorsal and not far behind pectorals, none of the rays forming exserted filaments. Gill openings wide; branchiostegals 10; pseudobranchiæ well developed. Gill rakers needle-shaped, rather numerous. Color silvery, with darker markings. Deep seas; four species known, resembling smelt. (χλωρός, green; ὀφθαλμός, eye.)

*a.* Eye 2 in head; scales 60 to 63. AGASSIZII, 818.
*aa.* Eye 3 in head; scales 45 to 52.
  *b.* Dorsal rays 11; depth 6¼ in length. CHALYBEIUS, 819.
  *bb.* Dorsal rays 8; depth 5½ in length. TRUCULENTUS, 820.

#### 818. CHLOROPHTHALMUS AGASSIZII, Bonaparte.

Head 3½; depth 5½; eye very large, about 2 in head. D. 11 or 12; A. 9; scales 60 to 63. Dorsal origin at ⅓ the distance from snout to base of caudal rays, its height about equal to that of the ventral, 5 times in total length; anal insertion about ¾ of distance from snout to base of caudal; ventral inserted under middle of dorsal; pectorals reaching nearly to middle of length of body. Color greenish bronze, with silvery reflections. (Goode & Bean.) Atlantic and Mediterranean, rare about Naples and Sicily. It also occurs at considerable depths in the eastern Atlantic. The French expedition obtained it off the Azores in 720 fathoms, also in the Sargasso Sea, 202 fathoms, and off the Cape Verdes, 230 to 290 fathoms. The *Albatross* obtained specimens from various localities in the Western Atlantic. (Named for Louis Agassiz, ichthyologist and teacher, "the best friend that ever student had.") (Eu.)

*Chlorophthalmus agassizii*, BONAPARTE, Fauna Italica, pl. 121, 1840, Italy; GÜNTHER, Cat., V, 404, 1864; GOODE & BEAN, Oceanic Ichthyol., 60, 1895.
*Aulopus agassizii*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XXII, 521, 1849.

### 819. CHLOROPHTHALMUS CHALYBEIUS* (Goode).

Depth 6¼; width 7¾. D. 11; A. 8; C. 16; P. 17 or 18; V. 9 or 10; scales about 6½–48–6. Body terete. Least height of the tail half that of body. The scales are moderately strong, sharply pectinated at the edge, and arranged in regular transverse rows, overlapping in such a manner as to resemble oblique plates upon the sides. Length of head to end of flexible flap of the operculum slightly more than ¼ of the body, and itself slightly more than 4 times length of snout. Orbit 4 times width of the interorbital space, 3 in length of head. Maxillary broad and flattened posteriorly, in length ⅒ of the body; it extends back to anterior margin of pupil. Mandible protruding beyond the snout. When the mouth is closed the tip of mandible projects noticeably. Dorsal almost midway between snout and adipose dorsal, its height almost equal to that of ventral; adipose dorsal over middle of anal, its length half diameter of orbit; distance of anal from snout about ¾ of the body length, its length of base equal to length of snout; its height to that of middle caudal rays; caudal furcate; pectoral long, subfalcate, inserted close to the branchial cleft, its tip extending to fourteenth scale of lateral line, its length twice that of mandible; ventral located ⅖ of distance from snout to base of caudal, directly under middle of dorsal. Color grayish, mottled with brown; scales metallic silvery. Gulf Stream, in from 85 to 167 fathoms. (*chalybeius*, iron-colored.)

*Hyphalonedrus chalybeius*, GOODE, Proc. U. S. Nat. Mus., III, 1880, (Feb. 16, 1881), 484, Gulf Stream off Rhode Island; (Type, No. 26092. Coll. Fish Hawk); JORDAN & GILBERT, Synopsis, 296, 1883.

*Chorophthalmus agassizii*, GÜNTHER, Challenger Report, XXII, 132, pl. L, fig. C, 1887; not of BONAPARTE.

*Chlorophthalmus chalybeius*, GOODE & BEAN, Oceanic Ichthyology, 60, fig. 71, 1895.

### 820. CHLOROPHTHALMUS TRUCULENTUS, Goode & Bean.

D. I, 8; A. I, 7; V. 9 or 10. Body subterete, somewhat compressed, its height 5½ in its length, its width about 8. The least height of the tail about 2⅓ in greatest height of body at the insertion of dorsal. Scales moderate, cycloid, arranged in regular transverse rows, overlapping in such manner as to resemble oblique plates on the sides. Lateral line rather inconspicuous, containing between 40 and 50 scales; about 6 scales between lateral line and origin of dorsal, and 6 or 7 between it and ventral. Greatest length of head from tip of projecting lower jaw a little more than ⅓ that of body, or 2½ times in length of snout; lower jaw projecting beyond tip of snout a distance equal to ¼ length of snout. Orbit nearly equal to snout, and about ⅓ length of head; width of interorbital space 2 in orbit. The maxillary broad and flattened posteriorly, about 8 times in length of body, not reaching perpendicular from anterior margin of the orbit. Insertion of the dorsal midway between tip of snout and adipose dorsal, its height greater than length of ventral, which is equal to greatest height of body; the adipose dorsal over middle of base of anal, its length ⅖ diameter of orbit. Distance of anal from snout about ¾ length of body, length of its base about ⅔ that of snout, its height equal to diameter of orbit; caudal furcate; pectoral long and strong, its length equal to distance from tip of snout to posterior margin of orbit, and about twice that of mandible; ventral inserted under the middle of base of dorsal, the distance from posterior margin of orbit equal to distance of the latter from snout. Color brownish. One specimen about 8 inches in length, obtained by the steamer *Blake*, at Station LII, off Barbadoes, in 158 fathoms. (Goode & Bean.) (*truculentus*, truculent.)

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* *Chlorophthalmus chalybeius* is not identical with *C. agassizii*, but is well separated by the smaller eye, longer, more conical snout, lower, more terete body, and larger scales. It closely resembles it, however, in general form. Dr. Günther's diagnosis of *C. agassizii* in the *Challenger* volume more nearly applies to *C. chalybeius*, and his figure is apparently of *C. chalybeius*. Specimens were obtained by the *Fish Hawk* in five localities ranging in depth from 101 to 156 fathoms, and by the *Albatross* from eleven stations at depths of from 85 to 167 fathoms.—*Goode & Bean.*

*Chlorophthalmus truculentus*, GOODE & BEAN, Oceanic Ichthyology, 61, fig. 72, 1895, off Barbadoes in 158 fathoms.

## Family LXX. BENTHOSAURIDÆ.

This small family of deep-sea fishes is allied to the *Synodontidæ* but with well-developed supramaxillaries widening backward and applied to the dentigerous intermaxillaries; pectorals inserted near the shoulders, and very long ventrals. (Gill.) It includes a single genus, *Benthosaurus*.

### 252. BENTHOSAURUS, Goode & Bean.

*Benthosaurus*, GOODE & BEAN, Bull. Mus. Comp. Zoöl., XII, No. 5, 168, 1886, (*grallator*).

Body long, somewhat compressed, tapering into a slender, elongate, caudal peduncle. Scales cycloid, of moderate size. Head slightly depressed; cleft of mouth wide, horizontal, the lower jaw projecting at its extremity and anteriorly at the sides; maxillary long, slender, dilated posteriorly; premaxillary very long, styliform, tapering, immovable. The intermaxillary and mandible with bands of small teeth, of uniform size, interrupted at the symphysis; a short oblong band of similar teeth on each side of the vomer, separated by a rather wide interspace; palate and tongue smooth. Eye very small, inconspicuous. Gill opening extremely wide, the branchiostegal membrane free from the isthmus. Gill rakers long and slender, numerous, about twice as many below the angle as above. Pseudobranchiæ absent. Branchiostegals eleven. All the fins well developed; no adipose dorsal; dorsal fin median, anal postmedian; caudal forked, with lower lobe produced; ventral seven-rayed, inserted opposite the interspace between pectoral and dorsal, the outer ray produced. (*βένθος*, deep; *σαῦρος*, lizard.)

#### 821. BENTHOSAURUS GRALLATOR, Goode & Bean.

D. 11; A. 12; P. 9; V. 7; B. 11; scales 9–55–8 or 9. Body elongate, somewhat compressed, depressed slightly forward, tapering behind into a long slender tail, its greatest height 7½ in its standard length, and equaling ½ length of head, its greatest width ⅓ length of head; its height at the origin of the anal ⅚ of its greatest height. Least height of tail half the height of body at ventrals; length of caudal peduncle 6½ times its least height. Scales very thin, cycloid, leathery, deciduous, oval in form, except at base of dorsal and anal fins, where they become more elongate; the horizontal diameter of a scale in the lateral line equals twice diameter of eye; lateral line straight, above the median line anteriorly, becoming median on caudal peduncle, the tube-bearing scales being prominent, and about 55 in number; about 9 rows of scales between dorsal fin and lateral line; between the latter and anal fin, 8 or 9 rows.

Head twice as long as greatest height of body, its length contained a little less than 4 times in the standard body length, considerably depressed, scaleless except on the vertex and the preoperculum. Operculum (perhaps accidentally) denuded. Snout much produced, almost equal to width of interorbital space, which is convex. Maxillary extending far behind eye, its length equal to postorbital part of head; mandible projecting beyond upper jaw a distance slightly more than diameter of orbit, with a series of 7 large pores on its lower surface; several similar pores under eye. Nostrils situated about midway between eye and extremity of snout, small, slit-like, the posterior about twice as large as the anterior one in each pair.

Dorsal inserted midway between tip of snout and base of middle caudal rays, highest in front, the length of the rays diminishing rapidly posteriorly; apparently no adipose dorsal; anal similar in shape to the dorsal, the anterior rays being longest, about equal in length to mandible, its distance from the snout about 3 times length of its longest ray, caudal forked, its middle rays $\frac{2}{5}$ as long as those in the upper caudal lobe; the lower lobe much prolonged, the lower ray being more than 4 times as long as the middle rays; its extremity broken off in our specimen, but apparently it must have been nearly twice as long as the stump which now remains; pectoral fin normal, inserted close to the opercular flap, its length slightly greater than that of the head (although mutilated), extending beyond origin of dorsal; ventral base entirely in advance of the perpendicular from the origin of the dorsal the inner rays reaching vent, while its outer ray is enormously prolonged, extending far beyond the extremity of the upper caudal lobe, the length of the prolonged ray fully 4 times that of head; ventrals close together.

Color brown, the roof of the mouth and inside of the branchiostegal flap black, as well as the operculum and branchiostegal membrane. One specimen, 15½ inches long to the tips of the prolonged ventral rays, was taken by the *Blake*, at a depth of 1,850 fathoms, at Blake Station CLXXIV, in latitude 24° 33′ N., longitude 84° 23′ W. A second example nearly the same size, taken by the *Albatross*, in latitude 39° 3′ 15″ N. and longitude 70° 50′ 45″ W., at a depth of 1,537 fathoms. (Goode & Bean.) (*grallator*, one who walks on stilts.)

*Benthosaurus grallator*, GOODE & BEAN, Bull. Mus. Comp. Zoöl., XII, No. 5, 168, 1886; GOODE & BEAN, Oceanic Ichth., 62, fig. 73, 1895, Gulf Stream. (Coll. Blake.)

## Family LXXI. BATHYPTEROIDÆ.

Characters of the family included below in those of its single genus:

### 253. BATHYPTEROIS, Günther.

*Bathypterois*, GÜNTHER, Ann. and Mag. Nat. Hist., 1878, 5th series, II, 183, (*longifilis*).
*Synapteretmus*, GOODE & BEAN, Oceanic Ichthyology, 64, 1895, (*quadrifilis*).

Shape of the body like that of *Aulopus*. Head of moderate size, depressed in front, with the snout projecting, the large mandible very prominent beyond the upper jaw. Cleft of the mouth wide; maxillary much developed, very movable, much dilated behind. Teeth in narrow villiform bands in the jaws; on each side of the broad vomer a small patch of similar teeth; none on the palatines or on the tongue. Eye very small. Scales cycloid, adherent, of moderate size. Rays of the pectoral fin much elongate, some of the upper being separate from the rest and forming a distinct division. Ventrals abdominal, 8-rayed, with the outer rays prolonged. Dorsal fin inserted in the middle of the body above, or absent; anal short.; caudal forked. Gill openings very wide; gill laminæ well developed, separate from each other; gills rakers long. Pseudobranchiæ none. Deep-sea fishes, the American species belonging to the subgenus *Synapteretmus*. (*βαθύς*, deep; *Pterois*, a genus of *Scorpænoid* fishes, with pectoral filaments.)

SYNAPTERETMUS (*συναπτός*, joined together; ἐρετμός, oar):

- *a.* Outer ventral rays filiform, simple, prolonged, appressed or inseparably united. End of dorsal and origin of anal in same vertical, or overlapping.
  - *b.* Anal origin in nearly same vertical as end of dorsal. Dorsal origin over axis of ventrals or nearly so. Ventral rays elongate.
    - *c.* Ventral outer rays appressed; lower caudal ray prolonged; upper pectoral ray not extending beyond upper lobe of caudal. A. 9; scales 59. QUADRIFILIS, 822.
    - *cc.* Ventral with the outer rays closely appressed; lower caudal lobe produced; upper pectoral ray as long as the whole fish. A. 10; scales 55. LONGIPES, 823.

### Subgenus SYNAPTERETMUS, Goode & Bean.

### 822. BATHYPTEROIS QUADRIFILIS, Günther.

Head 5; depth 7; B. 12; D. 14; A. 9; P. II, 9; V. 9; scales 6–59–8. Eye small, about 3 in snout, or 5 or 6 in postorbital portion of head. Uppermost and lowermost of the pectoral rays filiform, the former bifid for more than ⅔ its length, the latter simple. Outer ventral rays much prolonged, not dilated; dorsal inserted close to root of ventrals; adipose fin present, narrow. Head remarkably flat above and the width of the interorbital space greater than length of snout. Dorsal fin midway between tip of upper jaw and root of caudal; anal inserted immediately behind dorsal, its origin equidistant from roots of pectoral and caudal; caudal emarginate.

This species possesses not only the long detached upper pectoral ray, but also an equally long lower ray, which, however, is not removed from the remainder of the fin. The upper ray becomes bifid in its proximate third, and is accompanied by an extremely short rudimentary second ray; it scarcely reaches the caudal fin and is shorter than the lowermost ray, which may reach to the end of the caudal, and is split only at its very extremity. Structure of ventral fins as in *Bathypterois longipes*, but the strong outer rays are somewhat curved and do not reach the end of the anal. Scales cycloid, as in other species, but those behind the basal portion of pectoral fin are deeply pectinated, provided with from 5 to 10 long and narrow teeth, of which the middle ones are the longest. (Günther.) Color blackish or black; pectoral filaments whitish.

The types of this species were obtained by the *Challenger* off the coast of Brazil; two specimens, one from Station 126, at a depth of 770 fathoms, one from Station 121, at a depth of 500 fathoms. Other specimens obtained by the *Blake* off St. Vincent, and by the *Albatross* at Station 2385, in 740 fathoms, and at Station 2117, in 683 fathoms. (*quadrifilis*, having four threads.)

*Bathypterois quadrifilis*, GÜNTHER, Ann. & Mag. Nat. Hist., 1878, II, 184, off coast of Brazil, in 500 to 770 fathoms; GOODE & BEAN, Oceanic Ichthyology, 65, fig. 75, 1895.

### 823. BATHYPTEROIS LONGIPES, Günther.

B. 12; D. 13; A. 10; P. II, 7 or 8; V. 8; scales 6–55–8. Uppermost pectoral ray strongest, about as long as the whole fish, bifid toward its extremity; outer ventral rays much prolonged, strong, but not dilated at the extremity; dorsal fin inserted at some distance behind root of ventrals; adipose fin present or absent.

Similar to *Bathypterois longifilis*, differing in the following points: Eye minute; dorsal fin farther backward, its origin being nearly midway between end of snout and root of caudal; consequently the root of the ventral is some distance in advance of the dorsal, and the end of the dorsal is vertically opposite fifth anal ray. One specimen possesses, the other lacks, adipose fin. Caudal fin deeply forked, with the outer ray much produced. Of the two branches into which the posterior third of the long pectoral ray is split, one is much shorter and weaker than the other. Two outer ventral rays are closely appressed from the root to end, and much stouter and longer than the other rays; they are articulated to the end and without soft pads. These fin rays extend beyond the end of the anal fin. (Günther.) Color black, with white fins.

The *Challenger* obtained two specimens, 9 inches long, from off the east coast of South America, Station 325, depth 2,650 fathoms. Several specimens, 3 to 9 inches long, were obtained by the *Albatross* and the *Blake*. (*longus*, long; *pes*, foot.)

*Bathypterois longipes*, GÜNTHER, Ann. Mag. Nat. Hist., 1878, II, 184, east coast of South America in 2,650 fathoms; GÜNTHER, Challenger Report, XXII, 188, pl. 48, fig. A, 1887; GOODE & BEAN, Oceanic Ichthyology, 66, fig. 76, 1895.

## Family LXXII. IPNOPIDÆ.

The characters of this singular group of deep-sea fishes are included below in the account of the single genus.

### 254. IPNOPS, Günther.

*Ipnops*, GÜNTHER, Ann. Mag. Nat. Hist., 1878, II, 187, (*murrayi*).

Body elongate, subcylindrical, covered with large, thin, deciduous scales, and without luminous organs. Head depressed, with a long, thin, spatulate snout, like that of *Bathypterois*, but more depressed, its whole upper surface occupied by a pair of large, transparent, lamelliform membrane bones which cover a peculiar organ divided longitudinally into two symmetrical halves. These organs, which represent the eyes, were at first supposed to be luminous organs, but according to recent investigations of Professor Moseley they "show a flattened cornea extending along the median line of the snout, with a large retina composed of peculiar rods, which form a complicated apparatus, destined undoubtedly to produce an image and to receive especial luminous rays."[*]

Bones of lower part of head well ossified, mouth wide, the lower jaw projecting, and the maxillary dilated, as in *Bathypterois*. Jaws with narrow bands of villiform teeth, none on vomer or palatines. None of the fins filamentous; pectorals and ventrals near together, well developed. Dorsal inserted just behind vent; no adipose fin; anal moderate; caudal subtruncate. Gill rakers needle-shaped. No air bladder, pseudobranchiæ, nor pyloric cœca. One species known, widely distributed. (*ἰπνός*, lantern; *ὤψ*, eye.)

### 824. IPNOPS MURRAYI, Günther.

Head 6; depth 13½. D. 10; A. 13; P. 14; V. 8; B. 12; scales 55. Body very slender; head much broader than deep, the snout much depressed, its outline obtusely rounded; maxillary extending beyond middle of head. Gill rakers 10 + 22, long and close-set. Vent between ventral fins, slightly more than a head's length behind gill opening, and nearly twice as far from base of caudal as from tip of snout. Caudal subtruncate; pectoral reaching ventrals, a little more than half head; ventrals rather long, stronger than pectorals and placed well apart. Lateral line faintly indicated. Brown, fins colorless; membranes of mouth and gill cavity black. Length 5½ inches. A bottom fish found at about 2,000 fathoms, recorded from coast of Brazil, Tristan da Cunha, Celebes, and in tropical America, (24° 36′ N., 84° W.), and off Bequia. (Named for Dr. John Murray, naturalist on the *Challenger* expedition.)

*Ipnops murrayi*, GÜNTHER, Ann. Mag. Nat. Hist., 1878, II, 187, coast of Brazil, etc.; GÜNTHER, Voyage Challenger, Deep-Sea Fishes, 191, 1887; AGASSIZ, Cruises of the Blake, II, 32, fig. 215, 1888; GOODE & BEAN, Oceanic Ichthyology, 67, 1895.

## Family LXXIII. RONDELETIIDÆ.

Body more or less compressed, scaleless; head naked; no barbels; mouth large. Margin of the upper jaw formed by the premaxillaries only. Teeth coarsely granular. Opercular apparatus complete, its bones very thin, membrane-like; no adipose fin; dorsal fin far back, short and low, inserted opposite the anal; pectorals short, placed rather low. Ventrals present, abdominal. Gill opening very wide; membranes deeply cleft, free from the isthmus. Pseudobranchiæ absent. Deep-sea fishes. One species known. (Goode & Bean.)

(*Rondeletiidæ*, GOODE & BEAN, Proc. U. S. Nat. Mus., 1894 (1895), 454, and in Oceanic Ichthyology, 67, 1895.)

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[*] "The existence of well-developed eyes among fishes destined to live in the dark abysses of the ocean seems at first contradictory, but we must remember that these denizens of the deep are immigrants from the shore and from the surface. In some cases the eyes have not been specially modified, but in others there have been modifications of a luminous mucous membrane, leading on the one hand to phosphorescent organs more or less specialized, or on the other to such remarkable structures as the eyes of *Ipnops*, intermediate between true eyes and specialized phosphorescent plates. In fishes that have been blinded and retain for their guidance only the general sensibility of the integuments and of the lateral line, these parts soon acquire a very great delicacy. The same is the case with tactile organs (as in *Bathypterois* and *Benthosaurus*), and experiments show that barbels may become organs of touch adapted to aquatic life, sensitive to the faintest movements or the slightest displacement, with power to give the blinded fishes full cognizance of the state of the medium in which they live."—*Alexander Agassiz.*

### 255. RONDELETIA, Goode & Bean.

*Rondeletia*, GOODE & BEAN, Proc. U. S. Nat. Mus., 1894 (1895), 454, (*bicolor*); and in Oceanic Ichthyology, 68, 1895.

Body oblong, compressed, scaleless. Mouth large, lower jaw slightly projecting. Teeth in bands, coarsely granular in the jaws; vomer and palatines toothless; a row of large mucous pores on the lower surface of the mandible, and extending upward on the preoperculum. Posterior nostril with a slender filament anteriorly. Eyes moderate, near the dorsal profile. Snout rather long, obtuse. Supraoccipital bones with a pair of strong spines projecting horizontally forward over the orbit. Gill membranes entirely separate; gill rakers numerous, rather long and slender; gills 4, a narrow slit behind the fourth. Branchiostegals 7. Opercular bones thin, membranous. Dorsal short, rather low, opposite and similar to the anal; pectorals and ventrals small; caudal small, probably forked. No vestiges of a lateral line. (Dedicated to Guillaume Rondelet, "the great French ichthyologist of the seventeenth century," one of the ablest of the "Fathers of Ichthyology.")

#### 825. RONDELETIA BICOLOR, Goode & Bean.

Head about 2 in total length; depth 3; eye 6; snout 3. B. 7; D. 14; A. 14; P. 9; V. 5. Maxillary reaching to below the hind margin of eye. Origin of dorsal fin nearly opposite vent; origin of anal immediately behind vent, the terminations of the two opposite. Fins low, the rays pointing horizontally backward; longest dorsal ray 5 in head, longest anal ray 4; pectoral fin inserted below middle of body and under end of opercular flap, its length nearly ¼ that of head; ventrals inserted behind middle of total length, and still farther behind tips of the extended pectorals, their length about $\frac{2}{9}$ that of head, and when extended, reaching beyond vent. Color purplish black, with cherry-colored margins to the fins; whitish in spirits.

A single specimen 4¼ inches in length, was taken by the Fish Commission steamer *Albatross* at station 2724, at a depth of 1,641 fathoms. (Goode & Bean.) (*bicolor*, two-colored.)

*Rondeletia bicolor*, GOODE & BEAN, Proc. U. S. Nat. Mus., 1894 (1895), 454, pl. 17, fig. 1; and in Oceanic Ichthyology, 68, fig. 77, 1895. (Type, No. 38202. Coll. Albatross).

## Family LXXIV. CETOMIMIDÆ.

Body somewhat compressed, scaleless; head naked; lateral line conspicuous. No barbels. Mouth exceedingly large; the margin of the upper jaw formed by the premaxillaries only; the lower jaw strongly curved, and slightly projecting beyond the upper. Teeth in jaws in bands, granular; vomer, palatines, pterygoids, and also the first gill arch and the lingual bones (which are greatly enlarged), as well as the upper pharyngeals, covered with teeth of a similar character. Opercular apparatus incomplete, its bones very thin, membrane-like. No adipose fin; dorsal fin far back, short, high, inserted opposite the anal, which it resembles; pectorals short, placed rather low; ventrals absent. Gill opening immense, the membranes deeply cleft, free from the isthmus.

Gills 3. Pseudobranchiæ absent. (Goode & Bean.) Deep-sea fishes of uncertain relationship, bearing a singular resemblance to diminutive whales. Two species known. (*Cetomimidæ*, Goode & Bean, Proc. U. S. Nat. Mus., 1894 (1895), 451; and in Oceanic Ichthyology, 68, 1895.)

### 256. CETOMIMUS, Goode & Bean.

*Cetomimus*, Goode & Bean, Proc. U. S. Nat. Mus., 1894 (1895), 452, (*gillii*); and in Oceanic Ichthyology, 68, 1895.

Body oblong, compressed, scaleless; similar in its vertical outline and proportions to that of the right whales (*Balænidæ*), a resemblance which is greatly enhanced by the shape of the enormous mouth, and in the lower jaw, which is strongly curved, projecting slightly beyond the snout. Teeth in granular bands, covering all the bones of the mouth, tongue, and throat. Mucous pores sometimes present on the back. Nostrils far forward, open slits without flap. Eyes very small and placed far below the dorsal profile. Gill membranes deeply cleft, not attached to the isthmus; gill rakers absent, replaced by a granular tooth-like surface upon the arch; gills 3, no slit behind the third. Branchiostegals 9. Opercular apparatus incomplete, bones thin and membranous. Dorsal short, high, inserted very far back, directly opposite the anal, which it resembles in shape and size. Caudal peduncle short and slender. Ventrals absent; pectorals broad and short, placed low; caudal small, weak, probably emarginate or truncate. Lateral line broad, consisting of two furrows, connected vertically by numerous short cross grooves. (*κῆτος*, whale; *μιμέομαι*, to mimic.)

| | |
|---|---|
| *a.* Dorsal rays 16. | GILLII, 826. |
| *aa.* Dorsal rays 19. | STORERI, 827. |

#### 826. CETOMIMUS GILLII, Goode & Bean.

Head about 3; depth a little more than 4; B. 9; D. 16; A. 16; P. 16. Eye minute, about 23 in head, and about 8 in snout, inserted midway between margin of jaw and dorsal profile, distant from the former a space contained about 2½ times in length of snout. The maxillary reaches very far back, extending to a point behind orbit equal to 1½ times length of snout. Origin of dorsal directly above that of anal, which is inserted a short distance behind vent; distance from snout equal to more than 4 times length of its own base, and distance of its termination from root of upper rays of caudal equal to its own greatest height; anal similar in shape and extent to dorsal, but the thirteenth to the fifteenth rays the longest, while the eighth to eleventh are the longest in dorsal; length of these longest rays about equal in the two fins, and contained slightly less than 3 times in head; pectoral inserted somewhat below middle of body, close to extremity of opercular flap; broadly lanceolate, about 3½ times in head; ventrals lacking. Lateral line sweeping in a bold curve from a point above the upper angle of the gill opening to a point in middle of body between origin of dorsal and anal fins, and thence in a straight median line to base of caudal. Color blue-black.

A single specimen of this curious species, 5 inches in length, was taken by the *Albatross*, August 20, 1884, at station 2206, in 39° 35′ N. latitude, 71° 24′ 30″ W. longitude, at the depth of 1,043 fathoms. (Goode & Bean.) (Named for Dr. Theodore Gill.)

*Cetomimus gillii*, GOODE & BEAN, Proc. U. S. Nat. Mus., 1894 (1895), 452, pl. 17, fig. 2; and in Oceanic Ichthyology, 69, fig. 78, 1895, Gulf Stream. (Type, No. 35529. Coll. Albatross.)

### 827. CETOMIMUS STORERI, Goode & Bean.

D. 19; A. 16. Head 3½; depth about 4 in total length; eye 18 in head or 7 in snout, inserted nearer dorsal profile than to jaw, its position in the vertical being twice as far from the line of the upper jaw as from the dorsal line, and nearly in the line of the vertical erected from middle of upper jaw to the right angles of its edge. Lower jaw strongly curved, projecting far beyond upper. Origin of dorsal fin a little in advance of that of anal, which is inserted at a distance from the vent equal to 3 or 4 times diameter of eye; dorsal fin longer than anal, the termination of the latter being under the fifth ray from the end of the dorsal; they are about equal in height, and the direction of the rays when erected is backward and at an acute angle with the axis of the body; the longest rays about 2½ in head; pectoral fin inserted very far down, the lower portion of its peduncle almost on the abdominal line; the fin is lanceolate, and, although mutilated, is believed to have been about ½ as long as the head; lateral line in a sinuous curve from a point above the upper angle of gill opening to a point somewhat in advance of insertion of dorsal, and thence in a straight line to base of caudal. A line of mucous pores on either side of the median dorsal line in advance of dorsal.

A single specimen of this species, 4⅝ inches in length, was taken by the Fish Commission steamer *Albatross* at station 2222, on September 6, 1884, at a depth of 1,535 fathoms. (Goode & Bean.) (Named for David Humphreys Storer, the accomplished author of the History of the Fishes of Massachusetts.)

*Cetomimus storeri*, GOODE & BEAN, Proc. U. S. Nat. Mus., 1894 (1895), 453, pl. 17, fig. 3; and in Oceanic Ichthyology, 69, fig. 79, 1895, Gulf Stream. (Type, No. 35634. Coll. Albatross.)

## Family LXXV. MYCTOPHIDÆ.

### (THE LANTERN FISHES.)

Body oblong or moderately elongate, more or less compressed, covered with scales, which are usually cycloid, but sometimes ctenoid. Mouth wide, the entire margin of the upper jaw formed by the long and slender premaxillaries, closely adherent to which are the slender maxillaries. Teeth various, mostly villiform, and in bands in the jaws; also on the pterygoids, palatines, and tongue; and on the vomer in adults. No barbels. Gill membranes separate, free. Branchiostegals 8 to 10. Pseudobranchiæ well developed. Gill rakers long and slender. Lateral line usually present, the scales prominent and often enlarged. Cheeks and opercles scaly. Adipose fin present; dorsal fin short, median, of soft rays; pectorals and ventrals present; anal fin moderate; caudal forked. Air bladder small. Intestinal canal short. Luminous spots or photophores more or less regularly placed along sides of body; larger luminous glands often present on the head or on the caudal peduncle.

Species about 100, placed in one genus by Günther and Lütken, divided into many by Goode & Bean. Small fishes, very widely distributed in the open sea. They live away from the shores, ordinarily at a considerable depth, coming to the surface at night or in stormy weather, descending by day.

Until the recent review of the Mediterranean species by Raffaele and especially the admirable monograph by Dr. Lütken (Spolia Atlantica, part 2, 1892), the species were very imperfectly known. This masterly paper of Dr. Lütken has been followed by a very exhaustive account of the Atlantic species by Goode & Bean (Oceanic Ichthyology). Advance sheets of this paper have been kindly placed at our disposal by its authors, and our manuscript has been entirely recast to include the species there described. Lütken places the species in one genus, *Scopelus*, but "for convenience of study and comparison" Goode & Bean have thought it "best to break up this great polymorphous genus" into minor groups. We find, however, considerable difficulty in giving these smaller genera satisfactory definition, but on the whole we have found it more convenient to recognize them as distinct genera rather than to place them as subgenera under the common head of *Myctophum*. The extreme ranges of variation are greater than are usually recognized as occurring within the limits of a natural genus.

NOTE.—Dr. Raffaele and Dr. Lütken have shown the great importance of the position of the luminous spots or photophores as characters distinguishing the species of *Scopelidæ*. Dr. Lütken has proposed a system of nomenclature for them, as follows:

*Caudal* (or precaudal) spots or photophores, those 2, 3, or 4 in number at or near base of lower lobe of caudal, the first separated by a break from the anal series.

*Anal* spots, those forming a series from vent along base of anal and caudal peduncle; this series is usually interrupted above last part of anal, one or two spaces being without spots.

*Posterolateral* spots, or spots placed near the lateral line above the break in the anal series.

*Supra-anal* spots, usually 3 in number, forming an oblique series or a triangle between vent and lateral line.

*Ventral* spots, a series of 4 or 5 between ventrals and vent.

*Supraventral*, a single spot sometimes present between ventrals and lateral line.

*Thoracic* spots, a series, often irregular, of about 5, along breast.

*Pectoral* spots, usually about 3, about base of pectoral.

*Opercular*, 2 or 3 on opercle.

*Mandibular*, about 3 on mandible.

Besides these, *preocular*, *subocular*, *supracaudal*, and *infracaudal* luminous patches often occur. The luminous glands on tail are so often obsolete as to lose much of their value in classification. In this paper we have adopted in the descriptions written by us, the nomenclature of Dr. Lütken as above given. In the descriptions copied from Goode & Bean a somewhat different system is used, but we have preferred not to alter the language of these authors.

NOTE.—Goode & Bean (Oceanic Ichthyology) offer the following

### TENTATIVE ARRANGEMENT OF THE GENERA OF MYCTOPHIDÆ.

*I.* Body oblong, compressed. Teeth in jaws in villiform bands.
  *A.* Pectorals present.
    1. Dorsal and anal fins touching (or nearly so) the same vertical, or overlapping.
      *a.* Lateral line not at all, or but slightly, enlarged. Scales cycloid, smooth.
        *i.* *No luminous glands on head or tail.* (*Luminous scales sometimes present on tail, above or below.*)
          *x.* Head short, with limb of preoperculum nearly vertical; snout more or less blunt and declivous. Precaudal photophores 2.

Dorsal entirely in front of anal, and scarcely, or not at all, overlapping. Superanal photophores in two groups. MYCTOPHUM.

Dorsal operlapping anal. Superanals in one or two groups. BENTHOSEMA.

*xx.* Head long, limb of preoperculum oblique, snout conical and snake-like. Precaudal photophores 4 or 2 + 1.

Dorsal about equal to or shorter than anal, and not overlapping.

No orbital spines. LAMPANYCTUS.

Orbital spines. CERATOSCOPELUS.

Dorsal much longer than anal, and overlapping it.

Pectorals placed normally. NOTOSCOPELUS.

Pectorals placed very low. CATABLEMELLA.

*ii. Luminous glands on tail, but none on head.*

*x.* Dorsal and anal nearly equal, not touching same vertical.

Head somewhat conical, with limb of preoperculum slightly oblique.

Saddle-like gland on tail, above and below. LAMPADENA.

*iii. Large luminous glands on head, but none on tail.*

*x.* Superanal photophores in two groups.

Precaudal photophores 4.

One large, irregular gland occupying entire front of head. ÆTHOPRORA.

Four luminous glands on head, one in front of each eye and one on each infraorbital. COLLETTIA.

Precaudal photophores none.

A gland in front of each eye below the nostril.

Photophores and cephalic glands all divided into halves by horizontal septa of black pigment. DIAPHUS.

*b.* Lateral line obsolescent.

*i. No luminous glands. Photophores much as in typical genus.*

*x.* Head long, with oblique preopercular limb.

Dorsal overlapping anal, the latter much the longer. Pectoral very high.

Precaudal photophore 1. Apparently no photophores on head. TARLETONBEANIA.

*c.* Lateral line with scales much enlarged; scales hard, persistent.

*i. Luminous glands or scales on top of caudal peduncle; none on head.*

*x.* Scales cycloid. Anal passing behind soft dorsal.

Body elongate, fusiform; head short, with projecting snout.

Anal much longer than dorsal, but not overlapping. Caudal peduncle slender, elongate. STENOBRACHIUS.

One posterolateral photophore over break in superanal series. STENOBRACHIUS (ALYSIA and RHINOSCOPELUS).

Body ovate, compressed; head short, profile declivous; snout not projecting.

Anal somewhat longer than dorsal and overlapping it slightly. Caudal peduncle short and stout.

No posterolateral photophore. Superanals in unbroken series. ELECTRONA.

*xx.* Scales ctenoid. Anal terminating below soft dorsal.

Body elevated, somewhat compressed. Caudal peduncle rather slender.

Anal longer than dorsal, but scarcely overlapping. DASYSCOPELUS.

2. Dorsal and anal short, similar, far apart.

*a.* Scales large, very deciduous, covered with minute spines.

*i. No luminous glands on head or tail.*

*x.* Scales along belly with luminous centers. Photophores far from normal.

Head conical; rictus short.

Dorsal and anal equal, the latter placed with its center under soft dorsal. NEOSCOPELUS.

*b.* Scales (if present) very deciduous.

*i.* Mouth very large; maxillary much dilated at tip. SCOPELENGYS.

*B.* Pectorals rudimentary.

1. Dorsal and anal overlapping considerably.

*a. Luminous glands on tail, above and below. Photophores minute, irregularly placed.*

*i.* Head long, with oblique preopercular limb; snout conical; mouth terminal, horizontal. NANNOBRACHIUM.

*II.* Body elongate, cylindrical. Teeth in lower jaw in several series. SCOPELOSAURUS.

Besides the species mentioned below, very many others are known from the open Atlantic and Pacific, any of which are likely to be found off our coasts. Descriptions of most of the known species are given in the papers above mentioned of Lütken and of Goode & Bean.

- *a.* Dorsal fin not ending much, if any, before front of anal fin.
  - *b.* Caudal photophores 4 or 3, never 2; dorsal fin not much, if any, shorter than anal; body deep or slender, not much contracted behind, the caudal peduncle robust; edge of preopercle more or less oblique; pectorals long or short, placed rather low.
    - *c.* Dorsal fin very long, much longer than anal and overlapping the latter; pectorals small, narrow, placed low; head long and low, with small eye. MACROSTOMA, 257.
    - *cc.* Dorsal fin not much longer than anal.
      - *d.* Head without large luminous glands; pectorals long or short, with narrow base.
        - *e.* Pectoral fins long, reaching past ventrals; luminous glands on caudal peduncle above or below, occasionally present.
          - *f.* Orbit with a small antrorse spine or horn above front of each eye. CERATOSCOPELUS, 258.
          - *ff.* Orbit without antrorse spine above. LAMPANYCTUS, 259.
        - *ee.* Pectoral fin small or minute, not much longer than eye; usually a luminous blotch on caudal peduncle above or below, or both.
          - *g.* Scales in lateral line not larger than the others. LAMPADENA, 260.
          - *gg.* Scales in lateral line notably larger than the others. NANNOBRACHIUM, 261.
      - *dd.* Head with large luminous glands before or below eye; pectoral fins short and broad, placed low; eye very large; snout short and convex; scales in lateral line usually more or less enlarged, the pores luminous.
        - *h.* Photophores and luminous glands most of them divided into halves by cross partitions of black pigment giving the form of the letter $\theta$; a luminous gland in front of each eye below nostril. DIAPHUS, 262.
        - *hh.* Photophores simple, without septa.
          - *i.* Luminous blotches before and below eye separate. ÆTHOPRORA, 263.
          - *ii.* Luminous blotches before and below eye coalescent in one large blotch occupying whole front of head. COLLETTIA, 264.
  - *bb.* Caudal photophores 2, never 3 or 4; dorsal fin notably shorter than anal, its rays 9 to 14; anal rays 16 to 20; body deep anteriorly, the caudal peduncle slender; edge of preopercle nearly vertical; pectorals long, placed high; no luminous glands on head; eye large.
    - *j.* Lateral line well developed.
      - *k.* Scales cycloid.
        - *l.* Maxillary scarcely enlarged at tip; last rays of dorsal not behind first of anal.
          - *m.* Snout prominent, projecting beyond tip of lower jaw; scales of lateral line more or less enlarged; caudal peduncle very slender; usually a luminous gland on its upper surface. RHINOSCOPELUS, 265.
          - *mm.* Snout little prominent, scarcely projecting beyond tip of lower jaw; scales of lateral line usually not enlarged; no luminous glands on upper edge of tail; moderately elongate. MYCTOPHUM, 266.
        - *ll.* Maxillary abruptly dilated at tip; last ray of dorsal behind first of anal; form moderately elongate (not broad-ovate as in the European group *Electrona*). BENTHOSEMA, 267.
      - *kk.* Scales ctenoid, firm; tail with a luminous gland above. DASYSCOPELUS, 268.
    - *jj.* Lateral line obsolete; no glands on tail; scales crenulate. TARLETONBEANIA, 269

## 257. MACROSTOMA,* Risso.

*Macrostoma*, Risso, Europe Mérid., III, 447, 1826, (*angustidens*); not *Macrostomus*, Wied, 1817, a genus of insects.

*Notoscopelus*, Günther, Cat., v, 405, 411, 1884, (*resplendens*).

*Catablemella*, Eigenmann & Eigenmann, Proc. Cal. Ac. Sci., 2d series, III, 1890, 24, (*brachychir*).

Myctophids with the dorsal fin much longer than the anal, and overlapping the anterior half of the latter. Body elongate. Snout obtusely conical; jaws equal in front; cleft of mouth nearly horizontal; maxillary not dilated behind. No luminous glands on head or tail. Arrangement of photophores irregular. Precaudals 2 + 1 or 2, the last one high up. (μακρός, large; στόμα, mouth.)

*a.* Mediolaterals 3, in a curved, subvertical series; posterolaterals 2 or 3.
  *b.* Posterolaterals 2, horizontally side by side, under adipose dorsal.
    *c.* Caudal spots 3 (2 + 1); posterolaterals under soft dorsal; pectoral weak and short.
      *d.* Dorsal rays 21; anal 20; scales 42; anal photophores 8 + 8. QUERCINUM, 828.
      *dd.* Dorsal rays 16; anal 14; anal photophores 9 + 17. MARGARITIFERUM, 829.
    *cc.* Caudal spots 4 (2 + 2); first posterolateral under adipose dorsal, second behind it. D. 21 to 24; A. 17 or 18; anal series 8 or 7 + 6 or 7. ANGUSTIDENS, 830.
  *bb.* Posterolaterals 3, horizontally side by side; caudal spots 3 (2 + 1); last posterolateral under adipose dorsal; pectoral short and weak. D. 20 or 21; A. 16; scales 46; anal series 9 + 4. CASTANEUM, 831.
*aa.* Mediolaterals 2; posterolateral 1; caudal spots 3, the last at end of lateral line. D. 20; A. 18; scales 36. CAUDISPINOSUM, 832.

### 828. MACROSTOMA QUERCINUM (Goode & Bean).

Head 3⅔ to 4; depth 5⅔. D. 21 or 24; A. 19 or 20; scales 42. Eye moderate, nearly 4. Snout short, about ½ as long as the diameter of the eye. Mouth oblique and very large, the maxillary extending to angle of preoperculum. Length of upper jaw about ⅘ that of head. Origin of dorsal much nearer tip of snout than root of caudal, being over the twelfth scale of the lateral line and immediately above origin of ventral; length of its base equal to that of head, and longest ray ⅔ as long as head, its end over seventh ray of anal; pectoral short, not reaching to origin of ventral; anal origin about under twenty-first scale of lateral line, the length of the base equals that of head without snout, and the longest ray is about ½ as long as head; adipose fin very slender, its distance from end of dorsal equaling ½ length of head; caudal moderate, deeply forked. A large luminous spot near the angle of the preoperculum; 2 above the pectoral base and 1 below it; 1 just below the lateral line above the origin of the anal; 5 or 6 between the isthmus and the root of the ventral; a number of others not accurately counted. Color dark brown.

Mediolaterals 3, in curved subvertical line; posterolaterals 2, under the soft dorsal; precaudals 2 + 1, the last below the end of the lateral line; one of the precaudals very high up. Western Atlantic, at 700 to 800 fathoms; also in the Mediterranean. (Goode & Bean.) This is very likely

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*By the rules of the Amer. Ornithol. Union, *Notoscopelus* should be used instead of *Macrostoma*, as there is a prior genus *Macrostomus*. We regard the two as distinct, as they are spelled differently.

the original *elongatum* of Costa, rather than the species here called by that name (after Lütken). (*quercinus*, oak-like, from the tan-color.) (Eu.)

*Notoscopelus quercinus*, Goode & Bean, Oceanic Ichthyology, 84, fig. 97, 1895, Grand Banks. (Type, No. 43789. Coll. Albatross.)

### 829. MACROSTOMA MARGARITIFERUM (Goode & Bean).

Head 4; depth 5; eye moderate, about 4 in head. D. 16; A. 14. Least height of tail ½ of greatest height of body. Snout very short, compressed into a keel on its upper edge, its length scarcely more than ½ diameter of the eye. Gill rakers 9 or 10 above the angle, about 16 below, the longest about ⅔ the diameter of eye. Intermaxillary reaching almost to angle of preoperculum. Space between eye and hinder edge of preoperculum much less than diameter of the eye. Origin of dorsal much nearer tip of snout than root of caudal, about over ninth scale of lateral line, and in same vertical with origin of ventral; length of dorsal base nearly ⅓ of total (without caudal); the ventral does not quite reach to origin of anal; pectoral very short, its length only ⅓ that of head; no adipose dorsal; anal origin under eighteenth scale of lateral line; base of fin as long as head without snout; caudal moderately forked. On top of the caudal peduncle a long, linear mirror, nearly ½ as long as head, its width about ⅓ of its length. Several large phosphorescent spots on inner edge of mandible, a large one near angle of preoperculum.

Mediolaterals 3, in a curved, subvertical line. Posterolaterals 2, under soft dorsal. Superanals 9 + 7. Precaudals 2 + 2, the last below end of lateral line. Grand Banks of Newfoundland; known from two specimens. (Goode & Bean.) (*margaritifer*, bearing pearls.)

*Notoscopelus margaritifer*, Goode & Bean, Oceanic Ichthyology, 85, fig. 98, 1895, off Banquereau. (Type, No. 43775. Coll. Sch. Alice M. Williams of Gloucester.)

### 830. MACROSTOMA ANGUSTIDENS, Risso.

(Prick Fish; Maire d'Amplora.)

Head 4; depth 5½; eye moderate, 4⅖ in head. D. 21 to 24; A. 17 or 18. Caudal spots 4, 2 horizontally placed, 2 at base of caudal rays; posterolateral spots 2 or 3; anal spots about 8 + 7; supra-anal spots 3, not quite in line; ventral spots 5 or 6; a white or luminous spot on back of tail. Preopercle very oblique. Body elongate, the caudal peduncle not very slender. Head moderate, snout very short, low, but bluntish at tip; chin prominent; mouth not very oblique. Dorsal very high, anal long; pectoral slender, narrow, placed low, with 12 rays, not reaching ventrals. A luminous gland above and one below tail. Atlantic and Indian Oceans, Norway and Greenland. (Lütken; here described from Mediterranean examples.) It is not unlikely that several species are confounded under this name. According to Goode & Bean, the original *elongatum* may be the one called by them *quercinus*. (*angustus*, narrow; *dens*, tooth.) (Eu.)

*Macrostoma angustidens*, Risso, Europe Méridionale, III, 448, 1826, Nice; D. 22; A. 18.

*Scopelus elongatus*, Costa, Fauna Napoli, Pesci, I, 2, Scopelus, 1844, Naples; Lütken, Spolia Atlantica, II, 44, 1892; Lilljeborg, Sveriges Fiskar, VI, 25, 1889.

*Lampanyctus resplendens*, Richardson, Voy. Erebus and Terror, 42, 1845, Gulf of Guinea; Günther, Cat., V, 415, 1864.

*Scopelus kröyeri*, Malm, Goteberg Vetensk. Handl., 100, 1863, Bohuslan, Sweden.

*Scopelus pseudocrocodilus*, Moreau (fide Lütken).

*Myctophum brachychir*,[*] Eigenmann & Eigenmann, West American Scientist, 1889, 126, Cortez Banks.

### 831. MACROSTOMA CASTANEUM (Goode & Bean).

Head 4; depth $5\frac{1}{3}$. D. 20 or 21; A. 16; scales about 46. Eye moderate, its diameter nearly 4 in head, and more than 2 in snout. Mouth exceedingly wide, oblique, with jaws equal; maxillary extending backward almost to angle of preoperculum. Intermaxillary as long as maxillary, and toothed throughout its entire length. Maxillary very little expanded posteriorly. Origin of dorsal fin very much nearer tip of snout than root of caudal, being as far from snout as from front of pearl-colored patch on top of tail and somewhat in advance of origin of ventral; dorsal base considerably longer than head, the longest ray equaling length of postorbital part of head; caudal deeply forked; pectoral small and not reaching nearly to ventral, its length not much more than $\frac{1}{3}$ that of head; ventral insertion under fourth ray of dorsal, its length about $\frac{1}{2}$ that of head; anal base nearly equal to head without snout. Mediolaterals 3, in curved subvertical line; posterolaterals 3, horizontally side by side. Precaudals 2 + 1, last below the end of the lateral line. Last posterolateral under soft dorsal. Number of superanals 9 + 4. Grand Banks, two specimens known. (Goode & Bean.) (*castaneus*, chestnut-colored.)

*Notoscopelus castaneus*, Goode & Bean, Oceanic Ichthyology, 85, fig. 95, 1895, Grand Banks. (Type, No. 31706. Coll. Str. Fish Hawk.)

### 832. MACROSTOMA CAUDISPINOSUM (Johnson).

Head $3\frac{2}{3}$; depth $5\frac{1}{2}$. D. 36; A. 18 or 19; V. 8; lateral line 36 to 38. Eye moderate. Snout obtusely conical, with jaws equal in front. Cleft of mouth rather oblique. Origin of dorsal fin midway between extremity of snout and adipose fin, and above base of outer ventral rays, its last ray behind vertical from middle of anal. A series of from 6 to 9 small spines bent backward, above and below, before the root of caudal, the tips of neural processes. Pectoral fins shorter than ventral, and not extending beyond its root. Mediolaterals 2; posterolaterals 1; precaudals 2 + 1, the last at the end of the dorsal line; the single posterolateral in advance of the soft dorsal; number of superanals 7 + 4 (?). (Goode & Bean.) Atlantic Ocean, two specimens known, one from the western Atlantic at a depth of 1,782 fathoms, 39° N., 68° W. (*cauda*, tail; *spinosus*, spined.)

*Scopelus caudispinosus*, Johnson, Proc. Zoöl. Soc. Lond., 1863, 42, Madeira; Günther, Cat., v, 416, 1864.

*Notoscopelus caudispinosus*, Goode & Bean, Oceanic Ichthyology, 85, fig. 96, 1895.

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[*] Head $3\frac{1}{3}$ (4 in specimen examined); depth $4\frac{3}{4}$; D. 20 to 23; A. 18 to 20; scales 40. Luminous spots not described, probably as in *M. angustidens*, a white spot on back of tail; elongate, compressed; head long, slender, the snout pointed, the profile not much rounded; preopercular margin very oblique; mouth large, maxillary not dilated behind, $1\frac{2}{5}$ in head; eye moderate, 4 in head. Dorsal falcate, longer than anal; pectorals minute, not nearly reaching ventrals. Length $3\frac{1}{2}$ inches. Cortez Banks, near San Diego, in 45 fathoms. (Eigenmann.) Not evidently different from *M. angustidens*; a specimen examined by us, in poor condition, agrees perfectly with Lütken's account condensed above, so far as its characters can be ascertained. (βραχύς, short; χείρ, hand.)

## 258. CERATOSCOPELUS, Günther.

*Ceratoscopelus*, Günther, Cat., v, 405 and 412, 1864, (*madeirensis*).

Dorsal and anal fins touching the same vertical, but scarcely overlapping, the dorsal not greatly elongate. Scales of the lateral line somewhat enlarged. Head long; limb of preoperculum oblique; snout conical and snake-like. A spine above orbit on each side. No luminous glands on head or tail. Caudal photophores 4. (κέρας, horn; *Scopelus*.)

*a.* D. 13 or 14; A. 13; eye large; anal series 6 + 6; two posterolateral spots; four caudal spots. MADEIRENSIS, 833.

### 833. CERATOSCOPELUS MADEIRENSIS (Lowe).

Head 3; depth 4⅔. D. 13 or 14; A. 13; scales 36. Forehead with a bony projection or horn on each side above eye. Caudal spots 4, the last at base of middle rays; 2 posterolateral spots; anal spots about 6 + 6, the series not evenly placed; supra-anal spots forming an oblique series. Preopercle very oblique. Body rather elongate, the head large and heavy; eye large, twice length of the bluntish snout, 3½ in head; mouth large. Dorsal high, much shorter than anal; pectoral long and slender, reaching past front of anal. (Lütken.) Atlantic and Mediterranean, west to the Grand Banks, where it is rather common at about 1,500 fathoms. (Eu.)

*Scopelus madeirensis*, Lowe, Proc. Zoöl. Soc. Lond., 1839, 87; 1851, 250; and Trans. Zoöl. Soc. Lond., iii, 14, 1839, Madeira; Günther, Cat., v, 412, 1864; Raffaele, Mitt. Zool. Stat. Naples, ix, 184, pl. 7, fig. 9, 1889; Lütken, Vid. Med. Naturh. Foren., 208, 1891.

*Scopelus bonapartii*, Cuvier & Valenciennes, Hist. Nat. Poiss., xxii, 449, 1848, Nice.

*Ceratoscopelus madeirensis*,* Goode & Bean, Oceanic Ichthyology, 82, 1895.

## 259. LAMPANYCTUS, Bonaparte.

*Lampanyctus*, Bonaparte, Fauna Italica, fasc. xxvii, 1840, (*crocodilus*).

Body oblong, compressed, slender, the caudal peduncle rather robust. Scales deciduous, cycloid, those of the lateral line not enlarged, so far as known; lateral line well developed; number of caudal photophores 3 or 4, never 2; luminous blotches almost always present on upper or lower edge of tail, none on forehead. Head compressed, the mouth large, with subequal jaws; premaxillary very long and slender. Eye large; preopercular edge more or less oblique. Gill rakers long and slender. Dorsal fin large, larger than in *Myctophum*, not notably shorter than anal, its insertion little, if any, behind that of ventrals; rays of dorsal 11 to 24, those of anal 9 to 19. Pectoral fins narrow, well developed, inserted low. Species numerous, very widely distributed in the open sea. (λάμπτη, lamp; νύξ, night.)

*a.* Pectorals long and falcate.
  *b.* Caudal photophores 3 or 4, in two series, the last on or near end of lateral line.
    *c.* Mediolaterals 2; posterolaterals 2, nearly under adipose dorsal.

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* Height of body ⅕ of total length; length of head nearly ⅓. Least height of tail nearly ½ greatest height of body. Snout moderate. Mouth large, oblique; jaws equal. Maxillary very slightly expanded behind. Ventral reaches to vent, and pectoral almost as far back as ventral. Anal origin under about nineteenth scale of lateral line. D. 13; A. 12; scales 36.—*Goode & Bean*; from American specimens.

*d.* Snout short, sharp, not much decurved above; eye small, 5 in head. Scales 38 or 39; D. 12 or 13 (sometimes 14 or 15); A. 14 or 15 (rarely 17 or 18); anal series 6 to 8 + 8 to 12; eye small, about 5 in head; head long, snake-like, with large mouth. CROCODILUS, 834.

*dd.* Snout blunt, decurved; eye large, 3 to 3½ in head; scales 32 to 35.

*e.* Scales 35; D. 13 or 14; A. 14 or 15; pectoral reaching front of anal; no luminous glands on tail. TOWNSENDI, 835.

*ee.* Scales 32 or 33; D. 13; A. 15; anal series 7 + 6; pectoral reaching middle of anal; tail with a luminous gland above and below. ALATUS, 836.

*cc.* Mediolaterals 3; posterolaterals 2, in advance of adipose dorsal; caudal series 3 + 1; D. 12 or 13; A. 13 or 14. Scales 36; anal series 5 + 5; anterolaterals 2; pectoral reaching middle of anal; snout short; eye 4 in head. GUNTHERI, 837.

*bb.* Caudal photophores 4, in a continuous, nearly horizontal row; the last not approaching end of lateral line; mediolaterals 2; posterolaterals 2, nearly under adipose dorsal; D. 12; A. 16; scales 38; anal series 7 + 8; anterolaterals 3, horizontally placed, not approaching end of lateral line. GEMMIFER, 838.

*aa.* Pectorals comparatively short, slender; caudal spots 4, in a low, nearly horizontal series, the last much below lateral line; 1 posterolateral below adipose dorsal. D. 12; A. 12 or 13. Scales 36; anal series 5 to 7 + 5. LACERTA, 839.

### 834. LAMPANYCTUS CROCODILUS (Risso).

Head $3\frac{7}{11}$; depth $5\frac{5}{9}$. D. 12 to 15; A. 14 to 18; P. 14; scales 38 or 39. Four caudal spots, the last at base of middle rays; 2 posterolateral spots; anal spots variable, about 6 + 8; supra-anals 3, forming an obtuse-angled triangle. Preopercle extremely oblique. Body elongate, the caudal peduncle stout; snout very short, pointed; mouth very large, the chin projecting; eye small, 5 in head, close to the tip of snout. Dorsal high; pectoral long and slender, reaching front of anal. Atlantic and Mediterranean; rare; west to 33° N., 40° W. (Lütken.) (*Crocodilus*, a crocodile.) (Eu.)

*Gasteropelecus crocodilus*, RISSO, Ichth. Nice, 357, 1810, Nice.
*Scopelus crocodilus*, LÜTKEN, Spolia Atlantica, II, 43, 1892.
*Lampanyctus crocodilus*, GOODE & BEAN, Oceanic Ichthyology, 79, 1895.

### 835. LAMPANYCTUS TOWNSENDI* (Eigenmann & Eigenmann).

Head 3 to 3½; depth 4½ to 5; eye large, 3½. D. 13 or 14; A. 14 or 15; scales 35, those of lateral line not enlarged. Caudal spots 3, two below, with a third higher up at base of caudal; posterolateral spot present; anal spots 6 + 6 = 12; 4 between ventrals and anal. Form rather elongate, the head longer than in *Myctophum humboldti*, the tail deeper; preopercle about as in *M. humboldti*. Pectorals long and narrow, reaching nearly to front of anal, 1½ in body. Cortez Banks, near San Diego, in 45 fathoms. (Eigenmann.) A specimen examined by us is in poor condition, but the species is certainly a valid one, and allied to *Lampanyctus alatus*. (Named for Charles H. Townsend, naturalist on the *Albatross*.)

*Myctophum townsendi*, EIGENMANN & EIGENMANN, West American Scientist, 1889, 125, Cortez Banks. (Type, No. 41921. Coll. Eigenmann.)

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* "Phosphorescent spots of the head as in *californiense*, the spots in the ventral series fewer in number, 5 pairs on breast; 4 pairs between ventrals and anal; 6 pairs along base of anal; 6 pairs on caudal peduncle; 2 pairs on caudal peduncle above the spines. Spots of the sides as in *californiense*, with an additional spot on base of middle caudal rays, and another between the last of the anal pairs and the one below the tweny-fourth scale of the lateral line."—*Eigenmann.*

### 836. LAMPANYCTUS ALATUS, Goode & Bean.

Head 3½; depth 5; eye 3; snout nearly 2 in eye. D. 13; A. 17 or 18; scales 32–33. Least depth of tail about ½ greatest height of body. Snout short; upper and lower profile deeply curved, and with a median crest. Mouth large; length of upper jaw equal to greatest depth of body. Origin of dorsal nearer to tip of snout than to root of caudal; pectoral fin very long, reaching to at least middle of anal base; ventral short, not reaching to origin of anal; anal origin under end of dorsal; caudal moderate and deeply forked. A small phosphorescent body on the upper and lower edges of the tail at the root of the caudal; length of lower patch a little greater than diameter ef eye.

Mediolateral photophores 2; posterolaterals 2, the latter one above the other or nearly so. Precaudals in two groups, 2 + 1 or 3 + 1, the last at the end of the lateral line. Posterolaterals nearly under soft dorsal. Number of superanals 7 + 6. Three specimens taken by the *Albatross* from station 2393, in 28° 43′ N. latitude, 87° 14′ W. longitude, 525 fathoms. (Goode & Bean.) (*alatus*, winged.)

*Lampanyctus alatus*, GOODE & BEAN, Oceanic Ichthyology, 79, 1895, Gulf Stream. (Type, No. 43769. Coll. Albatross.)

### 837. LAMPANYCTUS GUNTHERI, Goode & Bean.

Head 3⅔; depth 5½; eye nearly 4. D. 13; A. 13; scales 36. Body much compressed. Least depth of tail ½ greatest depth of body. Snout short, about ½ diameter of eye. Mouth oblique, very large, the maxilla extending nearly to angle of preoperculum; maxilla very little dilated posteriorly. Length of upper jaw about ⅔ that of head. Dorsal origin a little nearer to tip of snout than to root of ventral, immediately over origin of ventral and eleventh or twelfth scale of lateral line; anal origin under the sixteenth scale of lateral line, its base short, about ⅔ length of head; adipose fin present, small, entirely behind the base of the anal; nine rows of scales between its posterior margin and the root of the caudal; pectorals very long, reaching to above middle of anal; ventral reaches almost to anal origin; caudal moderate, well forked. Mediolaterals 3; posterolaterals 2. Precaudals 2 + 1, the last at the end of the lateral line. Posterolaterals in advance of the first dorsal, forming a gently curved series continuous with anterior half of the broken supra-anal series. One specimen obtained by the Gloucester fleet. (Named for Dr. Albert Günther, Keeper of the Zoölogical Collections in the British Museum, and the author of "monumental works," the foundations of ichthyological work in the last half of the nineteenth century.)

*Lampanyctus güntheri*, GOODE & BEAN, Oceanic Ichthyology, 80, 1895, Grand Banks. (Type, No. 43777.)

### 838. LAMPANYCTUS GEMMIFER, Goode & Bean.

Head 3⅔; depth 5½. D. II, 12; A. II, 16; V. 8; P. 15, 16; scales 5–38–5. Least depth of tail ⅔ height of body. Eye large, nearly ¼ length of head. Distance between posterior margin of orbit and preopercular edge equal to diameter of eye. Snout obtuse, very short, its length less than half diameter of eye. Maxillary scarcely dilated behind. Origin of dorsal midway between tip of snout and dorsal mirror; base of dorsal equal to length of postorbital part of head, and about equal to longest dorsal ray; ventral origin slightly in advance of dorsal origin; pectoral reaches slightly beyond origin of anal. Scales smooth, those of the lateral line scarcely larger than others. Mediolateral photophores 2; posterolaterals 2, the latter one above the other, or nearly so. Precaudals 4, in nearly horizontal, though curved row, the last far below the end of the lateral line; anterolaterals 3, in nearly continuous line with lowest prepectoral and mediolaterals; number of superanals 7 or 8. The pearly mirror upon the upper edge of the caudal peduncle as long as the eye, and much longer than the one extending from the end of the anal to the root of the caudal; slender and narrow, ⅔ as long as the head. Gill rakers 6 above and 12 below angle of first arch, longest ⅔ as long as eye. One specimen from 39° 40′ N., 71° 35′ W., in 538 fathoms. (Goode & Bean.) (*gemmifer*, bearing buds or gems.)

*Lampanyctus gemmifer*, GOODE & BEAN, Oceanic Ichthyology, 81, fig. 88, 1895, Grand Banks. (Type, No. 35604. Coll. Albatross.)

### 839. LAMPANYCTUS LACERTA (Goode & Bean).

Head 3½; depth 5; eye moderate 3½. D. 13; A. 15; scales about 36. Greatest depth of head ⅔ of its length. Snout somewhat obtuse, rounded, with strong keel; its length about ½ diameter of eye. Cleft of mouth somewhat oblique, maxillary reaching to angle of preoperculum and somewhat dilated. Origin of dorsal much nearer tip of snout than root of caudal; pectoral slender, its middle rays elongate; ventrals inserted slightly behind the origin of dorsal, and reach to base of first anal ray; anal inserted behind end of dorsal base; caudal large, forked. Photophores arranged somewhat as in *M. punctatum*.

Mediolaterals 3; posterolateral 1; the former in an obliquely vertical row, as in *M. punctatum*, the latter under the soft dorsal. Precaudals in low horizontal line. Number of superanals 7 + 5. Three large pits in the mandibles also show luminous qualities. Color apparently light brown, the scales opalescent. Gulf Stream, at moderate depths; not rare. (Goode & Bean.) (*lacerta*, lizard.)

*Myctophum lacerta*, GOODE & BEAN, Oceanic Ichthyology, 74, fig. 83, 1895, Gulf Stream, Lat. 28° 38′ 30″ N. Long. 85° 52′ 30″ W. (Type, No. 43778. Coll. Albatross.)

## 260. LAMPADENA, Goode & Bean.

*Lampadena*, GOODE & BEAN, Oceanic Ichthyology, 85, 1895, (*speculigera*).

This genus or subgenus is very close to *Lampanyctus*, differing from the latter chiefly in the small pectoral. From *Nannobrachium*, which it approaches in this respect, the fact that the scales of the lateral line are not enlarged, perhaps sufficiently distinguishes it. The anal fin is rather short, its first ray being not in advance of the last ray of dorsal. As in *Lampanyctus* and *Nannobrachium*, the scales are readily deciduous, and it is not always easy to find the character of those in the lateral line from preserved specimens. Probably *Lampadena* and *Nannobrachium* should be merged in *Lampanyctus*. (λάμπη, light; ἀδήν, gland.)

### 840. LAMPADENA SPECULIGERA, Goode & Bean.

Head 4; depth 4½; eye very large, 3. D. 13; A. 14; V. 8; P. very small; scales 4–35–5. Least depth of tail ⅗ height of body. Greatest depth of head about ¾ of its length. Distance between posterior margin of orbit and preoperculum edge about ½ diameter of eye. Snout short, conical, its length about ⅓ diameter of eye. Cleft of mouth somewhat oblique, the lower jaw included. Posterior tip of maxillary distant from angle of preoperculum a space almost equal to length of snout. Origin of dorsal nearer tip of snout than root of caudal by a distance equal to ⅔ the length of its own base, and inserted nearly over root of ventral, over eleventh scale of lateral line, its last ray over vent in advance of origin of anal; pectoral not reaching nearly to vertical from origin of ventral, its length being equal to ½ that of upper jaw, and a little greater than diameter of eye; ventral not reaching to vent, its length equal to about ½ that of head. Scales smooth, those of the lateral line not larger than the others, the tubes passing through them luminous. Eight scales between the adipose fin and the margin of the pearl-colored dorsal patch; there are 35 scales in the lateral line, 4 above and 5 below it. The luminous spot, ⅔ as long as the diameter of the eye, club-shaped, on the top of the tail immediately in front of the base of the caudal ray. A similar spot on the lower edge of the caudal peduncle, a little in advance of the origin of the caudal rays, its posterior edge about in line with the center of the dorsal patch, its length about ¾ the diameter of the eye; a luminous gland above and below on caudal peduncle; no postanal series of superanal photophores, these being replaced by the subpeduncular glands; anterolateral 1; posterolaterals 2; precaudals in two groups, the anterior and lower one of two photophores widely separated from the posterior and single one, which is placed at the end of the lateral line; the single posterolateral is under the root of the soft dorsal, and considerably behind the termination of the anal. Gill rakers 6 above and 13 or 14 below the angle, the longest about ½ as long as the diameter of the eye. Color purplish brown; very glossy, almost iridescent. One specimen from 39° 48′ W., 70° 36′ N., at 551 fathoms. (Goode & Bean.) (*speculiger*, mirror-bearing.)

*Lampadena speculigera*, GOODE & BEAN, Oceanic Ichthyology, 86, 1895, Gulf Stream. (Type, No. 43797. Sch. Alice G. Wonson.)

## 261. NANNOBRACHIUM, Günther.

*Nannobrachium*, GÜNTHER, Deep-Sea Fishes, Challenger, 199, 1887, (*nigrum*).
*Stenobrachius*, EIGENMANN & EIGENMANN, Proc. Cal. Ac. Sci., III, 1890, 5, (*leucopsarum*).

This genus is closely allied to *Lampanyctus*, from which it differs chiefly in the small pectorals. Caudal peduncle with luminous blotches above and below. Photophores small, arranged about as in *Lampanyctus*. Scales of lateral line enlarged in all species, so far as known. Last ray of dorsal more or less behind first of anal. (νάννος, dwarf; βραχίων, arm.)

*a.* Anal spots 12 to 14; anal rays 14 or 15; last ray of dorsal about over third anal ray.
  *b.* Gill rakers 5 + 13 to 15; caudal spots 3 or 4; snout bluntish; photophores moderate.

*c.* Luminous patches above and below tail, occupying nearly whole length of caudal peduncle. LEUCOPSARUM, 841.
*cc.* Luminous patches above and below tail short. NANNOCHIR, 842.
*bb.* Gill rakers 5 + 10; caudal spots 3, the last above end of lateral line; snout rather acute; photophores minute. MEXICANUM, 843.
*aa.* Anal spots small, 16 to 18.
*d.* Anal rays 19; eye moderate or small, 5½ to 5¾ in head; caudal spots 3 or 4, the last well separated near end of lateral line; last ray of dorsal over sixth of anal; size large. REGALE, 844.
*dd.* Anal rays 16 or 17; eye 5 in head; last ray of dorsal over fifth of anal. MACDONALDI, 845.

### 841. NANNOBRACHIUM LEUCOPSARUM (Eigenmann & Eigenmann).

Head 3¾ to 3⅗; D. 12 to 15; A. 14 or 15; scales 35 or 36. Caudal peduncle deep, its least depth about half that of body. Luminous patches above and below tail, occupying nearly the whole length of caudal peduncle; caudal spots 3 or 4; anteroanal spots usually 6; ventral spots 5; 1 or 2 posterolateral spots. Body deep forward, the head long and pointed; maxillary shortish, reaching edge of preopercle, 1⅓ in head; cheek broader than in *N. nannochir*, less tapering behind; eye rather small, 3½ in head. Scales very thin, those of the lateral line much deeper than others; pectoral very short and narrow. Color rather pale; opercles with silvery luster; iris with silvery pigment; fins not quite black. Length 4 inches. Alaska to San Diego, in rather deep water; not rare. Locally very abundant in stormy weather off Point Loma. (λευκός, white; ψαρός, spotted, piebald.)

*Myctophum* (*Stenobrachius*) *leucopsarum*, EIGENMANN & EIGENMANN, Proc. Cal. Ac. Sci., March, 1890, 5, off Point Loma, Lower California, in stomachs of *Sebastodes*. (Type, No. 41916. Coll. Eigenmann.)

### 842. NANNOBRACHIUM NANNOCHIR (Gilbert).

Very close to *Nannobrachium leucopsarum*, differing chiefly in the longer body and head, and especially in the less development of the luminous patches on the tail.

Head 3¼ to 3⅖ in length; depth 5. D. 12 or 13; A. 15 or 16; scales 35 or 36. Gill rakers 5 + 13 to 15; caudal peduncle long and slender, its least depth ⅖ to ⅓ that of body; luminous patches on tail short, usually occupying ¼ to ⅓ length of caudal peduncle. Maxillary long, the preopercle very obliquely placed; the cheek long, tapering to an acute angle posteriorly. Anal spots 7 + 7. Ventral spots usually 5; no spot before eye. Coloration darker than in *N. leucopsarum*, the opercle black, the iris usually with silvery, the fins uniformly black. Length 5 inches. Alaska to Santa Barbara Islands, abundant in 300 fathoms, often in company with *Nannobrachium leucopsarum*, which it very closely resembles. (νάννος, dwarf; χείρ, hand.)

*Myctophum nannochir*,* GILBERT, Proc. U. S. Nat. Mus., 1890, 51, July. (Types, No. 1059, Stanford Univ. Mus., and 44291 U. S. Nat. Mus. Coll. Albatross); from station 3072, off coast of Washington.

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* Reexamination of the original types of *Myctophum nannochir* showed to Dr. Gilbert that two species were confounded by him under that name. One of these was almost simultaneously described by Eigenmann under the name of *leucopsarum*. The name *nannochir* has been restricted by Gilbert to the other.

### 843. NANNOBRACHIUM MEXICANUM (Gilbert).

Head 3½; depth 5¾; eye 4 to 4⅓ in head; snout 6½. D. 12; A. 14; scales 30 to 33; gill rakers 5 + 10. Caudal spots 3, the last one widely separated from the others and above end of lateral line; anal spots 6 + 6; posterolateral spots present, the uppermost on lateral line; 3 supra-anal spots in a series, 4 spots on course of lateral line and about equally distant; these are the upper pectoral, supraventral, upper supra-anal, and posterolateral spots; no spot before eye. Photophores all small; tail with luminous glands above and below. Body slender, the eye rather small, the snout comparatively acute; snout not projecting, the jaws equal; maxillary 1⅔ in head; scales very deciduous. Pectorals minute, of 3 or 4 rays only. Last ray of dorsal over fourth of anal. Length 2 inches. Coast of Lower California.

*Myctophum mexicanum*, GILBERT, Proc. U. S. Nat. Mus., 1890, 51, Albatross stations 3008 and 3009, Lower California. (Type, No. 44289. Coll. Albatross.)

### 844. NANNOBRACHIUM REGALE (Gilbert).

Head 3⅗; depth 5⅓; eye 5½ to 5¾. D. 16; A. 19; scales 37; gill rakers 5 + 10. Caudal spots 3 or 4, the last near end of lateral line, well separated from the others; anal spots 11 + 7; ventral spots 3; posterolateral spot present; a supra-anal spot halfway between vent and lateral line; a phosphorescent streak on caudal peduncle above and below. Body rather elongate, with stout caudal peduncle; snout pointed, lower jaw projecting beyond it; preopercular margin very oblique; eye small, slightly longer than snout; teeth on vomer evident. Scales entire, large, very deciduous, those along lateral line much larger. Front of dorsal slightly nearer adipose fin than eye, its origin over axil of ventrals; insertion of anal under its twelfth ray; last ray of dorsal over sixth of anal. Pectorals very slender, with 14 rays, the upper filamentous and produced to opposite base of ventrals; ventrals reaching vent. Black. Length 5 inches. Santa Barbara Channel in 600 to 820 fathoms. (*regalis*, royal.)

*Myctophum regale*, GILBERT, Proc. U. S. Nat. Mus., 1891, 544, Santa Barbara Channel. (Type, No. 44289. Coll. Albatross.)

### 845. NANNOBRACHIUM MACDONALDI, Goode & Bean.

Head 3½; depth 5. D. 13; A. 16 or 17; scales 4–35–4. Eye moderate, 5 in head, and considerably greater than snout. Mouth extremely wide, rather oblique. Premaxillary as long as maxillary; both bones narrow and rod-shaped. Gill laminæ very short; gill rakers long, needle-shaped, the longest a little longer than eye. Origin of dorsal nearer extremity of snout than root of caudal, its last ray opposite fourth or fifth ray of anal, while the origin of anal is opposite tenth ray of dorsal; the longest ray of the latter equal to length of head without snout; adipose fin small, opposite penultimate ray of anal; caudal much forked; pectoral composed of 3 or 4 small, short, delicate rays; ventral inserted slightly in advance of dorsal, and extending to vent. Phosphorescent organs arranged much as in *N. nigrum*. The glandular organ of white upon the top of the caudal peduncle much smaller than that described for *N. nigrum*, but it has possibly been partially obliterated; the one on the lower part of the peduncle is much larger. Coloration, purplish brown.

Type 5 inches in length, obtained by the *Albatross* from station 2553, in 39° 48′ N. latitude, 70° 36′ W. longitude, at a depth of 551 fathoms. In a second individual from the Gulf Stream the pectoral is much more developed than in the type, its length being ⅖ that of the head, and reaching nearly to origin of ventral. The species is abundant in the Gulf Stream, where many examples have been taken. (Goode & Bean.)

(Named for Marshall McDonald, United States Fish Commissioner.)

*Nannobrachium macdonaldi*, GOODE & BEAN, Oceanic Ichthyology, 94, fig. 100, 1895, Gulf Stream. (Type, No. 35545.)

## 262. DIAPHUS, Eigenmann & Eigenmann.

*Diaphus*, EIGENMANN & EIGENMANN, Proc. Cal. Ac. Sci., 2d Series, III, 1890, 3, (*theta*).

This genus is closely related to *Æthoprora*, its chief character being in the fact that all or nearly all of the photophores are divided by a horizontal cross septum of black pigment, giving them the form of the Greek letter *θ*, *theta*. This septum is readily injured or destroyed in badly preserved specimens. Two or three* species known. (*διά*, divided; *φῶς*, light.)

### 846. DIAPHUS THETA, Eigenmann & Eigenmann.

Head 3 to 3½; depth 3½ to 4; eye large, 3½ in head, 3 in length of the blunt snout. D. 11 to 13; A. 9 to 12; scales 34. Each of the luminous spots divided by a horizontal black line; 4 caudal spots; anal spots 5 + 5 or 6 = 10 or 11; no spot on base of middle caudal rays; 4 supra-anal spots in an oblique line; 2 or 3 posterolateral spots; a luminous blotch below eye varying more or less anteriorly; a small detached dot behind this; a photophore before eye above nostril; a flat, soft, glandular body attached by one side just above base of pectoral, nearly ½ the size of pupil; no glandular spots on tail. Body deep, compressed, with stoutish caudal peduncle; head short and deep, the profile convex. Scales entire, those of the lateral line somewhat enlarged. Pectorals small, placed low, rather short, not quite reaching ventrals. Length 2¾ inches. Point Loma, near San Diego, to Oregon, in deep water; the specimens†

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*Besides *Diaphus theta*, the character of divided photophores appears also in *Diaphus engraulis* (Günther) and in *Diaphus cæruleus* (Klunzinger). Lütken regards *engraulis* as a synonym of *cæruleus*. In *Diaphus cæruleus* there is a luminous blotch below eye as in *Diaphus theta*. The body in *D. cæruleus* is more elongate, and the dorsal ends just before first ray of anal.

†Concerning these specimens Dr. Gilbert observes:

"They are identical with the types of *Myctophum protoculus*, and are in a state of preservation sufficiently good to show the division of the luminous spots, a character not visible in the types of *M. protoculus*. It is obvious that the spots are divided into upper and lower halves which are structureally different, the narrow pigment band indicating this separation on the surface.

"The specimens before us show great variation in the size of the subocular luminous blotch, and indicate how little dependence can be placed on that character. In addition to the roundish supranasal blotch described by Eigenmann, the species possesses a more or less developed subocular bar. In one specimen the latter is a bare line, with a minute point separated from it posteriorly. In others it is wider, and in the extreme in this respect we find a bar, the width of which is ⅓ the diameter of the pupil. There remains constantly separated from it the small dot already referred to. A peculiar soft flattish body ½ as large as pupil is attached by one edge to the shoulder girdle just above the insertion of the pectoral fin. It is constantly present and uniform in position in all specimens seen, including the types of *theta* and *protoculus*. It may be a luminous organ, though it has not strikingly the appearance of one, and its nature may be considered problematical."

examined by us (*Albatross* Coll.), from off Point Arena, Humboldt County, California, in 455 fathoms. (*theta*, from the form of the luminous spots.)

*Diaphnus theta*, Eigenmann & Eigenmann, Proc. Cal. Ac. Sci., March, 1890, iii, 4, Point Loma, near San Diego. (Coll. Eigenmann.)

*Myctophum protoculus*, Gilbert, Proc. U. S. Nat. Mus., 1890, July, 52, coast of Washington, in 584 fathoms, Albatross Station 3072; specimens in poor condition, not showing division of photophores. (Type, No. 41922. Coll. Albatross.)

### 263. ÆTHOPRORA, Goode & Bean.

*Æthoprora*, Goode & Bean, Oceanic Ichthyology, 86, 1895, (*metopoclampa*).

Body oblong, compressed, resembling *Myctophum* in form; covered with large scales, those in the lateral line very slightly larger than the others. Head compressed. Snout very obtuse and short, projecting slightly beyond orbital margin, the jaws about equal. Eye moderate. Dorsal fin premedian, entirely or almost entirely in advance of the anal, which it closely resembles in shape and dimensions; ventral with 8 rays inserted under the anterior portion of the dorsal; pectorals moderate, placed low; adipose fin long and prominent. Luminous gland of irregular form occupying the front of the head in advance of eye; usually another below eye; these separate from their fellows on the other side; a luminous spot or glandular body of greater or less extent upon the body at the angle of the preoperculum and, in some species, others upon the interoperculum and upon the sides of the lower jaw. Precaudal photophores 4, forming a more or less crescent-shaped line at the base of the lower caudal lobe. Deep seas; very close to *Diaphus*, differing only in the simple photophores. (*αἶθος*, glow, and *πρῷρα*, prow, front.)

*a*. Scales 35 or 36.
  *b*. Anterolateral photophores 2; mediolaterals 2; posterolaterals none. LUCIDA, 847.
  *bb*. Anterolateral photophores 1; mediolaterals 3 or 4; posterolaterals 2. EFFULGENS, 848.

### 847. ÆTHOPHRORA LUCIDA, Goode & Bean.

Head 3⅔; depth 4½; eye about 4. D. III, 14; A. II, 14; scales 35. Least depth of tail 2⅕ in height of body. Head considerably longer than high, its height equal to distance from anterior margin of pupil to end of opercular flap. Snout short, but less declivous and obtuse than in *Æ. metopoclampa*. A pearl-colored luminous organ touching the limb of orbit, but separated from it above and below, with posterior lobe not prolonged far back, and with a space between its lower margin and the opening of the jaw. Cleft of mouth oblique and curved, the maxillary reaching to angle of preoperculum and not dilated. Origin of dorsal and ventral nearly in same vertical, that of former midway between anterior margin of orbit and adipose fin; that of latter midway between tip of snout and adipose fin; insertion of the last ray of dorsal over interspace between third and fourth rays of anal; pectoral (unless mutilated) only half as long as ventral, and its tip does not approximate the vertical from its origin; dorsal and anal similar, the former with its upper margin concave; adipose dorsal inserted over interspace between antepenultimate and penultimate anal rays, and as long as ultimate dorsal ray. Scales smooth, those of lateral line scarcely enlarged.

Type specimen with 13 photophores in the anal series; a wide break over roots of last 2 rays of anal; no posterolaterals; 2 mediolaterals, the anterior the lowest; two anterolaterals, the anterior and highest very small, above the axil of the pectoral or very near the lateral line, the posterior one somewhat more than midway between this and the anterior of the mediolateral group, and forming, with the two photophores in that group, an obtuse isosceles triangle, with the anterior of the medial group at its apex; of the 4 precaudal photophores the last 3 are the most nearly together, and form a nearly vertical line at the base of the lower caudal lobe; a large, apparently luminous, pearl-colored spot under tip of flap of opercle. One specimen about 4 inches long, obtained by the *Albatross* at station 2127, in 19° 45′ N. latitude, 75° 04′ W. longitude, in 1,639 fathoms. (Goode & Bean.) (*lucidus*, shining.)

*Æthoprora lucida*, Goode & Bean, Oceanic Ichthyology, 88, fig. 102, 1895, Gulf Stream. (Type, No. 44084. Coll. Albatross.)

### 848. ÆTHOPRORA EFFULGENS, Goode & Bean.

Head nearly 4; depth 4; eye large, 2½ in head. D. II, 13; A. II, 14; scales 35 or 36. Least depth of tail ½ height of body. Head considerably longer than high, the flap of operculum extending above and behind axil of pectoral. Snout exceedingly short and obtuse, as in *Æ. metopoclampa*; the luminous organ enormous, gland-like, overlapping entire anterior margin of orbit, extending down upon edge of jaw and extending backward almost as far as in *Æ. metopoclampa*. Cleft of mouth oblique, somewhat curved, the maxillary reaching nearly to angle of preoperculum. Origin of dorsal somewhat in advance of vertical from that of ventral, which touches root of second dorsal ray; last dorsal ray over roots of short spines preceding anal; insertion of ventrals considerably posterior to a point equidistant from root of adipose dorsal and anterior margin of the orbit; origin of adipose dorsal over interspace between antepenultimate and ultimate anal rays; pectoral stout and much shorter than ventral, not reaching much more than halfway to its root. Scales smooth, those in the lateral line somewhat enlarged, shiny, and conspicuous; the lateral line descending in a gentle curve to a point above origin of ventral. Arrangement of the photophores very peculiar. A break in series of superanals, there being 5 on lower part of caudal peduncle behind anal; apparently 2 posterolaterals, the posterior and highest near lateral line, and forming the beginning of a series of 8, arranged in an arc of a circle, the last being the highest in the group of mediolaterals, of which there are 4; but one anterolateral, which is above axil of ventrals, slightly behind it and about midway between it and lateral line; a large, triangular, luminous patch in the space between the axil of pectoral and the flap of opercle, which covers its anterior portion, and is itself decorated with a circular photophore; apparently a luminous patch along anterior margin of preopercle. Two specimens from deep water in the Western Atlantic. (Goode & Bean.) (*effulgens*, shining out.)

*Æthoprora effulgens*, Goode & Bean, Oceanic Ichthyology, 88, fig. 103, 1895, Brown's Bank and Albatross Station 2127, 19° 45′ N., 75° W., in 639 fathoms. (Type, No. 43770.)

### 264. COLLETTIA, Goode & Bean.

*Collettia*, **Goode & Bean**, Oceanic Ichthyology, 83, 1895, (*rafinesquei*).

This genus is scarcely distinct from *Æthoprora*, differing only in the greater development of the luminous areas about the eye. These coalesce into one large irregular luminous blotch, occupying whole front of head, suggesting the headlight of an engine. (Named for Robert Collett, the distinguished ichthyologist of the University of Christiania.)

*a.* Dorsal rays 12; anal 15; scales 32 to 35; head 3 in length; depth 4. RAFINESQUEI, 849.

*aa.* Dorsal rays 14; anal 15; scales and spots (except luminous gland below eye) undescribed; head 4¾ in length with caudal. NOCTURNA, 850.

#### 849. COLLETTIA RAFINESQUEI (Cocco).

Head 3; depth 4; eye 2⅔. D. 12; A. 15; scales 32 to 35. Body stout, short, moderately compressed; with a rounded, blunt snout, very large mouth, and comparatively small eye; comparatively short, triangular dorsal and anal, the former entirely in advance of the latter and inserted very far forward. Caudal peduncle stout, its height nearly ½ height of body. Eye moderately large; distance between posterior margin of orbit and preopercular edge ½ diameter of eye. Snout very short, obtuse, keeled, with profile abruptly declivous, its length ⅓ diameter of eye. Cleft of mouth slightly oblique, the lower jaw received within the upper. Mouth rather large, the maxillary extending to angle of preoperculum and behind orbit a distance equal to ⅔ diameter of eye, its posterior extremity not dilated, and entirely concealed under the scales of the cheek. Origin of dorsal over that of ventral, considerably nearer to tip of snout than to root of caudal, its last ray in advance of origin of anal; ventral stout and long, reaching to origin of anal; pectoral small, reaching to root of ventral; anal origin under the twelfth scale of lateral line, its last ray directly under adipose dorsal. Scales in lateral line somewhat enlarged, luminous. Anterolaterals 4, very irregular, the three posterior ones forming an isosceles triangle, as in *Æ. metopoclampa*; mediolaterals 3, arranged much as in *Myctophum punctatum*: posterolaterals 2, arranged much as in *Æ. effulgens* (perhaps only one posterolateral, if the photophore immediately below it should be recognized as belonging to the superanal series); superanals in two groups, 5 or 6 in the first, 4 in the last; precaudals 4, in nearly straight line, the last and uppermost at or near extremity of lateral line, the others descending forward at an angle of approximately 45 degrees with axis of body. (Goode & Bean.) (Named for Constantine Samuel Rafinesque, the eccentric and gifted naturalist, who first discovered the genus *Myctophum*, while studying the fishes of Palermo.)

*Myctophus rafinesquei*, Cocco, Alcuni Salmon., etc., 20, 1820, Messina.
*Scopelus rafinesquei*, **Günther**, Cat., v, 410, 1864; **Lütken**, Spolia Atlantica, II, 30, 1892.
*Collettia rafinesquei*, **Goode & Bean**, Oceanic Ichthyology, 83, 1895.

#### 850. COLLETTIA NOCTURNA (Poey).

Head 4¾ in total length, with caudal; depth 6; eye large, 3 in head, D. 14; A. 15. Luminous spots undescribed. Body rather robust; snout short; maxillary reaching beyond eye for a distance equal to ¾ diameter of eye; pectoral small, reaching front of dorsal; ventrals broad; anal lower than dorsal; an oblique, pale streak below eye. Coast of Cuba, caught in nets at night; rare. (Poey.) Probably a species of *Collettia*, and apparently related to *C. rafinesquei*, but this is not certain. (*nocturnus*, nocturnal.)

*Myctophum nocturnum*, POEY, Memorias, II, 426, 1861, Cuba. (Coll. Poey.)

## 265. RHINOSCOPELUS, Lütken.

*Alysia*, LOWE, Proc. Zoöl. Soc. London, 1839, 87, (*loricata* = *coccoi*; name preoccupied).
*Rhinoscopelus*, LÜTKEN, Vid. Selsk. Naturv. Copenhagen, VII, 1892, 237, (*coccoi*).

Body oblong, slender, compressed, with slender and elongate caudal peduncle covered with smooth, stiff scales, those in the lateral line much larger than the others. Head compressed; cleft of mouth very wide; the jaws about equal, the snout projecting beyond the tip of lower jaw. Premaxillary long and slender; maxillary well developed, reaching nearly or quite to the angle of the preoperculum, without considerable posterior dilation. Teeth in villiform bands in the jaws, on the palatines, pterygoids, and tongue. Eye moderate, its diameter less than ⅓ of the length of the head. Gill rakers very long and slender. Dorsal fin premedian; pectoral large; adipose dorsal small; anal fin larger than dorsal; pectoral narrow, elongate. Precaudals 2; supra-anals about 18, in two groups, the break being over the middle of the long anal fin and at the end of the first third of the series, approximately; anterolaterals 1 or 2; mediolaterals 2 or 3. Species few, mostly of the Atlantic. (*ῥίν, snout; *Scopelus*.)

*a.* Supra-anal spots forming an obtuse angle; anal spots 15 to 20. COCCOI, 851.
*aa.* Supra-anal spots in a straight, oblique series; anal spots 13 to 17. ANDREÆ, 852.
*aaa.* Supra-anal spots not in a straight line series; anal spots 12 to 13. BARUS, 853.

### 851. RHINOSCOPELUS COCCOI (Cocco).

Head 5⅛; depth 4½ to 5; eye 4. D. 10 to 12; A. 20 or 21; V. 8; scales 1–41–3. Tail slender, elongate, its least depth ¼ height of body. Distance between posterior margin of orbit and preorpercular edge ⅜ diameter of eye. Preopercular edge obliquely descending. Snout conical, the upper part projecting beyond the lower, the upper and lower profiles nearly equally curved; maxillary extending to the angle of preoperculum and scarcely dilated. Dorsal origin nearer end of snout than to root of caudal, and behind base of ventral; last ray of the dorsal in vertical from second anal ray; pectoral reaching middle of ventral. In some specimens each of the scales on the back of the tail has a pearl-colored dot, probably a sexual character of the male; back and nape blackish; sides silvery, with gold and silver reflections; inside of the mouth blackish; iris silvery, the pupil transparent. (Goode & Bean.) Western Atlantic, very abundant among the surface fishes of the Gulf Stream, rare in the Mediterranean, and ranging from Newfoundland to Africa. (Named for Anastasio Cocco, an Italian naturalist, who carefully studied the deep-sea fishes which he could secure.) (Eu.)

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* Goode & Bean adopt for this genus the name *Stenobrachius*. *Stenobrachius*, Eigenmann, was intended to replace *Alysia*, but its type, *leucopsarum*, is a *Nannobrachium* and not closely related to the type of *Alysia*.

*Scopelus coccoi*, Cocco, Giorn. Sci. Litt. Art. Sicilia (No. 77), Palermo, 1829, 143 ("Scopelo de Cocco"), Palermo; Günther, Cat., v, 413, 1864; Günther, Challenger Report, xxxii. Pelagic Fishes, 30, 1887; Lütken, Spolia Atlantica, ii, 236, 1892.

*Alysia loricata*, Lowe, Proc. Zoöl. Soc. Lond., 1839, 87, Madeira.

*Stenobrachius coccoi*, Goode & Bean, Oceanic Ichthyology, 91, 1895.

### 852. RHINOSCOPELUS ANDREÆ (Lütken).

Head 3⅝; depth 4½. D. about 10; A. about 20. Two caudal spots; a posterolateral spot; 3 supra-anal spots forming an oblique series; anal spots about 5 or 6 + 9 or 10, the series slightly interrupted; spots along belly in continuous series. Body deep anteriorly, tapering to a slender caudal peduncle; snout pointed, projecting beyond lower jaw; preopercle with its margin considerably oblique. Pectoral long, falcate. Open Atlantic and Indian Ocean. (Lütken.) Common in the Gulf Stream along our coasts with the preceding, of which Goode & Bean think it may be a sexual variation. (Named for Capt. A. T. Andreas, who collected this and other oceanic fishes for the museum at Copenhagen.)

*Scopelus andreæ*, Lütken, Spolia Atlantica, Scopelini, 25, 1892, North Atlantic.

*Stenobrachius andreæ*, Goode & Bean, Oceanic Ichthyology, 91, fig. 104, 1895.

### 853. RHINOSCOPELUS RARUS (Lütken).

Head 3½; depth 4½. D. about 14; A. about 20; scales 39. Caudal spots 2; posterolateral 1; anal spots about 6 + 7; supra-anal spots not forming a straight line, usually 2 in number; thoracic and ventral spots few, not equidistant. Body rather short and plump, the caudal peduncle rather slender; snout moderate, projecting beyond lower jaw; pectoral short and small, not reaching the small ventral; preopercular margin not very oblique. Eye moderate. Open Atlantic, west to 50° W., 33° N. (Lütken.) (*rarus*, rare.)

*Scopelus rarus*, Lütken, Spolia Atlantica, 26, ii, 1892, North Atlantic.

## 266. MYCTOPHUM, Rafinesque.

*Myctophum*, Rafinesque, Indice d'Ittiologia Siciliana, 56, 1810, (*punctatum*).

*Scopelus*, Cuvier, Règne Animal, Ed. i, 56, 1817, (*humboldti*).

*Nyctophus*, Cocco, Giorn. Sicil., 44, 1829, (emended orthography of *Myctophum*).

Body oblong, compressed, covered with cycloid scales, those in the lateral line not much enlarged; the caudal peduncle rather slender. Head short, compressed, with limb of preoperculum nearly vertical. Mouth large, the jaws about equal; premaxillaries long and slender; maxillaries well developed. Snout more or less blunt and declivous. Teeth in villiform bands on jaws, palatines, pterygoids, and tongue. Eye large. Gill rakers long and slender. Air bladder small. Dorsal fin entirely in front of anal, overlapping it little or not at all; ventrals 8-rayed, under or but slightly in front of first dorsal rays; pectorals well developed; soft dorsal slender. Precaudal photophores 2; superanals in two groups, with one or two posterolaterals above the interval between them. Species rather numerous, widely distributed. (Name unexplained, usually derived from νύξ, night, and φῶς, light; hence altered by Cocco to *Nyctophus*. But we see no warrant for this supposed etymology. Rafinesque did not know that the spots were luminous.)

*a.* Mediolateral photophores 3, in obliquely vertical line; anterolateral 1; posterolateral 1.

*b.* Pectoral short; caudal photophores close together.

*c.* Posterolateral photophore in front of soft dorsal; D. 12; A. 19; scales 41 to 45. PUNCTATUM, 854.

*cc.* Posterolateral under adipose dorsal.

*d.* Scales 37; anal spots 7 to 10 + 4 to 6. AFFINE, 855.

*dd.* Scales 40; anal spots 8 + 6; D. 12; A. 20. OPALINUM, 856.

*aa.* Mediolaterals 2; posterolaterals 2.

*e.* Posterolateral spot 1, over break in the anal series.

*f.* Pectoral long, falcate, reaching middle of dorsal; caudal spots separated; posterolateral before adipose dorsal, behind middle of anal; anal spots 7 to 9 + 4 to 9.

*g.* D. 12; A. 20; scales 41. HUMBOLDTI, 857.

*gg.* D. 14; A. 22; scales 42. CALIFORNIENSE, 858.

*ff.* Pectorals moderate, barely reaching front of dorsal; scales 41; posterolateral much before adipose dorsal, over middle of anal; anal spots 5 to 7 + 11 to 14. D. 12; A. 19. GRACILE, 859.

*ee.* Posterolateral spots 2, over the break in anal series.

*h.* Anterolaterals side by side, but well apart; precaudals near together; the last far below end of lateral line; scales 39 or 40; D. 12 or 13; A. 17 or 18; anal spots 5 to 6 + 6 to 7. BENOITI, 860.

*hh.* Anterolaterals not side by side, the first above and before second, touching lateral line. Scales 38 to 42; anals 5 to 7 + 6; D. 12; A. 19 to 22. HYGOMII, 861.

### 854. MYCTOPHUM PUNCTATUM, Rafinesque.

Head 3¾; depth 4½; eye 2½. D. 12; A. 19; scales 41 to 45. Least depth of tail ⅖ height of body. Greatest depth of head about ¾ its length. Distance between posterior margin of orbit and preopercular edge ⅓ diameter of eye. Snout very short, with a very inconspicuous keel on upper edge, its length scarcely ⅓ diameter of eye. Eye very large. Premaxillary reaching almost to angle of preoperculum. Origin of dorsal much nearer tip of snout than to root of caudal, the fin very short, the length of its base equal to ½ that of head and less than ⅙ of total; its origin over eleventh scale of lateral line, and vertical with origin of ventral, below twelfth scale of lateral line, its length equal to that of postorbital part of head; adipose dorsal present, over antepenultimate ray of anal; anal origin under twenty-first scale of lateral line, its base as long as head, and its longest ray equal to length of postorbital part of head; caudal rather small and deeply forked. Mediolateral photophores 3, in straight, obliquely ascending line; anterolateral photophore single; posterolateral single, over break in row of superanals and placed considerably in advance of soft dorsal; precaudal photophores close together. (Goode & Bean.) Warmer parts of the Atlantic; abundant off the Grand Banks and from the Gulf Stream across to the Mediterranean. (*punctatus*, spotted.) (Eu.)

*Myctophum punctatum*, RAFINESQUE, Indice d'Ittiol. Siciliana, 56, pl. II, fig. 5, 1810, Palermo; GOODE & BEAN, Oceanic Ichthyology, 71, fig. 80, 1895.

*Scopelus caninianus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XXII, 445, 1849, coast of Italy; GÜNTHER, Cat., V, 409, 1864; RAFFÆLE, Mitt. Zoöl. Stat., Naples, IX, pl. VII, fig. 4, 183, 1889; LÜTKEN, Vid. Med. Naturh. Forh., 207, 1891.

*Scopelus mülleri*, GOODE, Hist. Aquatic Animals, Sec. I, pl. 203, 1884.

### 855. MYCTOPHUM AFFINE (Lütken).

D. about 14; A. about 20; scales 43. Caudal spots 2; posterolateral 1; anal spots about 8 + 6 in a right line; supra-anal spots 3, forming an oblique series. Body moderately elongate, the head deep and blunt, the snout not half the diameter of the large eye, which is about 3 in head; pectoral short, reaching past front of dorsal; anal high. Open Atlantic, west to 63° W., 38° N. (Lütken.) (*affinis*, related, to *M. caninianus*= *M. punctatum.*)

*Scopelus affinis*, LÜTKEN, Spolia Atlantica, II, 32, 1892, open Atlantic.

### 856. MYCTOPHUM OPALINUM, Goode & Bean.

Head 4¼; depth 4⅔; eye about 2⅔. D. 12; A. 20; scales 40. Least height of tail ⅖ height of body. Snout very short, declivous, with a well-developed median keel, its length about ⅓ diameter of eye. Eye large. Premaxillary reaching nearly to angle of preoperculum, broadly expanded at its extremity and partly concealed by the large scales of the cheek. Space between eye and hinder edge of preoperculum only ½ diameter of eye. Origin of dorsal much nearer tip of snout than to root of caudal, midway between snout and adipose fin, over eleventh scale of lateral line and very slightly behind vertical through origin of ventral; length of dorsal base ⅔ that of head; origin of ventral under tenth scale of lateral line; it does not reach to vent; pectoral short, its length nearly ⅔ that of head; adipose dorsal present, its origin over thirtieth scale of lateral line; anal origin under eighteenth scale of lateral line, the end of its base under thirtieth scale; length of anal base equal to that of head; caudal rather small, moderately forked. Mediolateral photophores 3, in straight, obliquely ascending line; anterolateral 1; posterolateral 1, under soft dorsal and over and slightly in advance of break in row of superanals, which is above root of last ray of anal. Number of superanals 8 + 6. In most of the specimens examined, the 6 or 8 scales on the top of the caudal peduncle, immediately in front of the caudel fin, are luminous. (Goode & Bean.) Western Atlantic. (*opalinus*, like opal.)

*Myctophum opalinum*, GOODE & BEAN, Oceanic Ichthyology, 72, fig. 81, 1895, Gulf Stream. (Type, No. 43808. Coll. Albatross.)

### 857. MYCTOPHUM HUMBOLDTI (Risso).

Head 3¾; depth 5; eye 3, large. D. 12 to 14; A. 20 to 22; scales 40 to 42. Caudal spots 2, near together and horizontally placed; one posterolateral spot; supra-anal spots 3, forming an obtuse angle with the apex forward; anal spots about 8 + 8, the series slightly interrupted Body moderately elongate, with slender caudal peduncle, the snout rather blunt, not projecting beyond the mouth; preopercular margin slightly oblique. Pectoral long, reaching middle of dorsal and middle of length of ventrals. Least depth of tail ⅖ of height of body; depth of head 1⅗ in its length. Distance between posterior margin of orbit and preopercular edge ½ diameter of eye. Snout short, obtuse, its upper profile descending in strong curve. Maxillary reaching nearly to angle of preoperculum, and slightly dilated behind. Origin of dorsal somewhat nearer to end of snout than to root of caudal, above root of inner ventral rays; its last ray before vertical from origin of anal; pectoral long, extending to posterior third of ventral. Scales smooth, stiff.

Mediolateral photophores 2; anterolaterals 2; posterolateral 1, (over break in anal series) which, as in *Myctophum punctatum*, is considerably in advance of the vertical connecting the root of the soft dorsal with those of the last rays of the anal; caudal photophores somewhat apart, as in *Myctophum phengodes*; superanals 7–9 + 4–9. Length 4 inches.

Open seas, abundant in the Mediterranean and in the Atlantic off both coasts. If *Myctophum boops* and *Myctophum californiense* are the same, as is possible, the species is also not rare in the eastern and southern Pacific. As, however, no other species of *Myctophidæ* is common to the Atlantic and Pacific coasts of North America, we may provisionally regard *M. californiense* as distinct from *M. humboldti*. (Named for Alexander von Humboldt, 1769–1859, author of "Cosmos," whose interest in the relations of life to surroundings included some exact knowledge of fishes.) (Eu.)

*Gasteropelecus humboldti*, RISSO, Ichth. Nice, 358, 1810, Nice.

*Scopelus humboldti*, GÜNTHER, Cat., v, 407, 1864; LÜTKEN, Spolia Atlantica, II, 34, 1892; GOODE & BEAN, Oceanic Ichthyology, 73, fig. 82, 1895.

### 858. MYCTOPHUM CALIFORNIENSE, Eigenmann & Eigenmann.

Head 3¾; depth 5; eye very large, 3 in head (specimens of 4 inches). D. 14; A. 21; scales 42. Phosphorescent spots arranged exactly as in *M. humboldti*. Body compressed, elongate, with long slender tail. Head short and deep; preopercular margin little oblique; maxillary 1½ to 1⅓ in head. Scales entire. Ventrals reaching beyond vent nearly to anal; pectorals short, (not reaching in the type to second third of ventrals). Cortez Banks, near San Diego. Very close to *M. humboldti*, but said to have shorter pectorals. It is probably not distinct, as in one of Dr. Eigenmann's types examined by us, the pectorals are as long as in *M. humboldti*. Both pectorals have been partly digested, but the slender rays on both sides reach middle of dorsal and beyond middle of ventrals.

?*Myctophum boops*,[*] RICHARDSON, Voy. Erebus and Terror, 39, 1845, open sea between Australia and New Zealand.

*Myctophum californiense*, EIGENMANN, West American Scientist, Nov. 9, 1889, 124, San Diego.

?*Scopelus boops*, GÜNTHER, Cat., v, 408, 1864.

### 859. MYCTOPHUM GRACILE (Lütken).

Head 5; depth 4¾; eye small, about 4 in head. D. 12; A. 19; scales 41. Caudal spots 2, very close together; posterolateral 1; anal spots about 6 + 12, in a slightly interrupted series; supra-anal spots 2, well separated. Body slender, the head deep, the snout not very blunt; pectoral moderate, reaching front of dorsal. Open Atlantic, west to 48° W., 23° N. (Lütken.) (*gracilis*, slender.)

*Scopelus gracilis*, LÜTKEN, Spolia Atlantica, 35, II, 1892, open Atlantic.

?*Myctophum hians*, RICHARDSON, Voy. Erebus and Terror, 41, pl. 27, 1845, open sea, locality unknown.

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[*] This nominal species, as Lütken has noted, agrees with *M. humboldti* in all respects except that the scales are said to be fewer, 37 to 39 in the lateral line instead of 41. The eye is a little larger, about 3⅓ in head. This species is from the open Pacific, between Australia and New Zealand. It has also been recorded (by Günther) from Vancouver Island, but doubtless the closely related *M. californiense* has been taken for it. Perhaps both *boops* and *californiense* are identical with *humboldti*.

### 860. MYCTOPHUM BENOITI (Cocco).

Head 3¼; depth 4. D. 12 or 13; A. 17 or 18; scales 39 or 40. Snout obtuse conical; eye large, nearly half head. Dorsal inserted nearly midway between snout and root of caudal behind ventral; pectoral nearly reaching tip of ventral. Mediolateral spots 2; anterolaterals 2; posterolaterals 2, over break in anal series; anterolaterals far apart; caudals near together, the last far below end of lateral line; a luminous plate on caudal peduncle; anal spots 5 or 6 + 6 or 7. (Goode & Bean.) Mediterranean to Norway and Greenland. (Named for M. Benoit.) (Eu.)

*Scopelus benoiti*, Cocco, Lett. su Salmon., 12, pl. II, fig. 4, 1838, Messina; GÜNTHER, Cat., V, 406, 1864; LÜTKEN, Spolia Atlantica, 256, 1892.
*Myctophum benoiti*, GOODE & BEAN, Oceanic Ichthyology, 74, 1895.

### 861. MYCTOPHUM HYGOMII (Lütken).

Head 3⅔; depth 4; eye about 2½. D. 12; A. 21 or 22; scales 38 to 42. Least height of tail about ⅔ of its greatest height. Snout very short, the upper and lower profile of the head being similar, its length a little less than ½ diameter of eye. Intermaxillary reaching as far back as maxillary, nearly to angle of the preoperculum; maxillary expanded posteriorly and concealed under large scales of cheek. Space between eye and hinder edge of preoperculum ⅓ diameter of the eye. Origin of dorsal nearer tip of snout than root of caudal, being over eleventh scale of lateral line, and nearly over origin of ventral; base of dorsal ⅔ as long as head, length of longest ray equaling length of head without snout; ventral not quite reaching vent; pectoral as long as head, reaching to above anal origin; anal origin nearly under end of dorsal base, the length of anal base a little greater than that of head; caudal rather small and forked. Posterolaterals 2, over break in superanal series and far apart, the anterior one nearly over middle of anal fin, the posterior one about one scale in advance of the vertical from the root of the soft dorsal; anterolaterals widely separated, the first obliquely in advance of and above the second, and touching or upon the lateral line, the second far behind the root of the ventral and over the interval between the first and second postventral photophores; superanals 7 + 6. (Goode & Bean, as *M. remiger*.) (Named for Captain V. Hygom, collector of some of Dr. Lütken's "Spoils of the Atlantic.") (Eu.)

*Scopelus hygomii*, LÜTKEN, Spolia Atlantica, Scopelini, 257, 1892, north Atlantic.
*Myctophum remiger*, GOODE & BEAN, Oceanic Ichthyology, 75, 1895, western Atlantic. (Type, No. 43972. Coll. Albatross.)

## 267. BENTHOSEMA, Goode & Bean.

*Benthosema*, GOODE & BEAN, Oceanic Ichthyology, 76, 1895, (*mulleri*).

This genus differs from *Myctophum* in having the maxillary dilated at tip. The dorsal fin considerably shorter than anal, but overlapping it, reaching to the vertical from the middle. Body elongate; caudal peduncle somewhat stout; eyes large; snout very short, with declivous upper profile; maxillaries considerably dilated behind; scales of the lateral line considerably enlarged. Northern seas. (*βένθος*, the ocean depths; *σῆμα*, a constellation of stars.)

*a.* Posterolateral spot 1 on each side; anal spots nearly in a straight series; caudal spots not close together. MULLERI, 862.

*aa.* Posterolateral spot wanting; caudal spots close together; anal spots in a series nearer horizontal than vertical; snout rather sharp. ARCTICUM, 863.

### 862. BENTHOSEMA MULLERI (Gmelin).

Head 4; depth 4. D. 12 to 14; A. 16 to 18; V. 8; scales 36 to 40. Depth of head equal to its length. Eye large, its diameter more than ⅓ length of head. Snout very short, obtuse, with upper profile descending in a very strong curve. Cleft of mouth oblique; maxillary reaching to angle of preoperculum and terminating in triangular dilation. Origin of dorsal a little nearer tip of snout than root of caudal, and inserted well behind root of ventral; pectoral very small, its length equal to diameter of eye; ventral not reaching to the vent. Scales smooth, those of lateral line larger. A luminous spot on the angle of the preoperculum; mediolaterals 2, in subhorizontal line continuously with the 2 anterolaterals; posterolateral 1, over break in series of anals; superanals 6–7 + 8–9. (Goode & Bean.) North Atlantic, occasionally taken in deep water from Norway to Greenland, more abundant southward, to South Carolina, probably always in very deep water. (Named for Otto Friedrik Müller, an early writer on the fishes of Denmark.) (Eu.)

*Salmo mülleri*, GMELIN, Syst. Nat., 1378, 1788, Norway; after STROM.

*Scopelus glacialis*, REINHARDT, Overs, 36, 1835, Greenland; LÜTKEN, Spolia Atlantica, 30, 1892.

*Scopelus mülleri*, COLLETT, Norsche-Nord-Havs Exp., 158, 1880; LILLJEBORG, Sveriges och Norges Fiskar, VI, 20, 1889.

*Myctophum glaciale*, JORDAN & GILBERT, Synopsis, 283, 1883.

*Benthosema mülleri*, GOODE & BEAN, Oceanic Ichthyology, 76, 1895.

### 863. BENTHOSEMA ARCTICUM (Lütken).

Head 3⅗; depth 4. D. 9; A. 17. Posterolateral spot (near lateral line, above last part of anal) entirely wanting, the anal spots forming a continuous line, 15 or 16 in number; caudal spots 2, close together; supra-anal spots 3, forming an oblique line; preopercular margin almost vertical. Body stout, short, the caudal peduncle not slender, the snout not projecting beyond chin; eye moderate; dorsal fin high. Davis Straits, Greenland. (Lütken.)

*Scopelus arcticus*, LÜTKEN, Spolia Atlantica, Scopelini, 29, 1892, Davis Straits.

## 268. DASYSCOPELUS, Günther.

*Dasyscopelus*, GÜNTHER, Cat. Fish. Brit. Mus., v, 405, 1864, (*asper*).

Dorsal and anal fins touching the same vertical, but not overlapping. Scales hard, persistent, ctenoid, those of lateral line much enlarged. Anal terminating below adipose dorsal. Body elevated, somewhat compressed; caudal peduncle rather slender; luminous scales on the back of the caudal peduncle. Arrangement of photophores much as in *Myctophum*. Species few; remarkable for the firm, rough scales. (*δασύς*, rough; *Scopelus:* Scopelus is an old name of some large-eyed fish, from *σκοπέω*, to look.)

*a.* Jaws subequal; anal spots 12 to 14; supra-anal spots in an oblique series. SPINOSUS, 864.

### 864. DASYSCOPELUS SPINOSUS (Steindachner).

Head 4 to 4⅓; depth 4 to 4⅓. D. 13; A. 19; scales 40–9. Body short, the snout very short; eye large; scales ctenoid; caudal spots 2; ventral spots more than 4; posterolateral spot single; supra-anal spots 3, forming an oblique series; anal spots 12 to 14; preopercular margin almost vertical. Open seas, known from the mid-Atlantic, Hawaiian Islands, etc. (Lütken.) (*spinosus*, spinous.)

*Scopelus spinosus*, STEINDACHNER, Sitzgber. Ichth. Notiz., v, 11, 1867, China; LÜTKEN, Spolia Atlantica, Scopelini, 19, 1892.

## 269. TARLETONBEANIA, Eigenmann & Eigenmann.

*Tarletonbeania*, EIGENMANN & EIGENMANN, Proc. Cal. Ac. Sci., IV, 1890, 7 (*tenua*).

This genus is close to *Myctophum*, differing chiefly in the entire absence of the lateral line. (Named for Dr. Tarleton Hoffman Bean, Ichthyologist of the United States National Museum, who has written largely on deep-sea fishes and on the fishes of the eastern Pacific.)

*a.* Ventral outline more arched than the dorsal; ventrals short, not reaching halfway to vent. CRENULARIS, 865.
*aa.* Ventral and dorsal outlines about equally arched; ventrals reaching halfway to seventh anal ray. TENUIS, 866.

### 865. TARLETONBEANIA CRENULARIS (Jordan & Gilbert).

Head 3¾; depth 4⅕. Eye large, 3⅓ in head. D. about 12; A. about 16; scales about 45. Caudal spots probably 2, making with the anal and postlateral spots a series of 21; 6 ventral spots. Body much compressed, bluntly convex anteriorly, tapering behind. Caudal peduncle long and very slender; ventral outline more arched than dorsal. Head short and high, the snout very blunt. Scales of sides crenulate, those of back with acute crenations, but no spines; no lateral line. Origin of dorsal nearer snout than base of caudal; caudal peduncle with 2 or 3 spinules (exserted tips of vertebral processes); ventrals reaching not halfway to vent; pectorals to base of ventrals. Color dark steel-blue. Santa Barbara Channel; coast of Washington; two small specimens known, one from the stomach of an albacore, the other blown on a vessel during a storm. (*crenularis*, slightly scalloped.)

*Myctophum crenulare*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1880, 274, Santa Barbara. (Type, No. 27402. Coll. Jordan & Gilbert.) JORDAN & GILBERT, Synopsis, 282, 1883.
*Myctophum procellarum* (Bean MS.) JORDAN, *l. c.*, 457, off Straits of Fuca.

### 866. TARLETONBEANIA TENUA, Eigenmann & Eigenmann.

Head 3¾; depth 4⅓. D. 12; A. 17. Caudal spots probably 2, making a series of 16 with the anal spots; 6 ventral spots; a posterolateral spot; 3 supra-anal spots in an oblique series; 5 thoracic spots. Body moderately deep, greatly compressed, the caudal peduncle very slender, its depth 4½ in greatest depth of body; ventral and dorsal outlines equally arched. Preopercular margin nearly vertical, the head formed as in *M. humboldti*. No lateral line; scales of sides much larger than those of back or belly; smaller scales denticulate, larger crenulate. Origin of dorsal midway between tip of snout and base of caudal; anal larger than dorsal; pectorals reaching ventrals, which reach halfway to seventh anal ray. Coronado Islands, near San Diego; one specimen from stomach of *Sebastodes miniatus.* (Eigenmann.) Very close to *T. crenularis,* but the belly less arched, the anal spots fewer, and the ventrals slightly longer; probably identical with the latter.

*Tarletonbeania tenua* (*tenuis*), EIGENMANN & EIGENMANN, Proc. Cal. Ac. Sci., IV, 1890, 7, Coronados. (Type, No. 41882. Coll. Eigenmann.)

## Family LXXVI. MAUROLICIDÆ.

Body moderately elongate, compressed, scaleless. Barbels none. Margin of the upper jaw formed by the maxillary and premaxillary, both of which are provided with teeth. Opercular apparatus incomplete. Gill opening very wide, the outer branchial arch extending forward to behind the symphysis of the lower jaw. Pseudobranchiæ present. Air bladder none. Adipose fin rudimentary. Series of luminous photophores present along the lower side of the head, tail, and body. A single dorsal fin without spinous rays. (Goode & Bean.) Genera 4 or 5, with some 8 or 10 species; deep-sea fishes. (*Sternoptychidæ,* group *Cocciina,* Günther, Cat., v, 387, 1864.)

*a.* Gill rakers very short; dorsal fin on hinder half of body.
  *b.* Dorsal fin well forward, its last ray inserted nearly over the first of anal; luminous spots over and behind anal forming a nearly continuous series.
    *c.* Luminous spots appearing as impressions on the skin, not placed on black globular bodies; anal rays 25 to 30; double row of spots behind pectorals ceasing at ventrals. MAUROLICUS, 270.
    *cc.* Luminous spots occuring as "convex pearls, each sitting on a black globular body;" anal rays about 14; double row of spots behind pectorals reaching anal. VINCIGUERRIA, 271.
  *bb.* Dorsal fin farther back, nearly opposite anal, its first ray nearly over the front of anal; luminous spots over and behind anal gathered in 5 clusters of 2 to 4 each, the spots on a black background; star-shaped pigment spots along lateral line; anal rays about 24. VALENCIENNELLUS, 272.

### 270. MAUROLICUS, Cocco.

*Maurolicus,* COCCO, Lett. su. Salmon., 32, 1838, (*amethystino-punctatus*).

Body oblong, compressed, covered with silvery pigment; series of luminous spots along the lower side of the head, body, and tail, those over and behind anal forming a nearly continuous series; luminous spots appearing as simple impressions on the skin. Scales wanting, or perhaps present in life, but very thin and caducous. Head compressed, the bones thin, but ossified. Cleft of mouth wide, very oblique, the lower jaw prominent. Maxillary large, broad, toothed on its edge, produced backward, receiving the slender premaxillary in the upper concave part of its margin; both jaws with minute teeth; no teeth on vomer or palatines. Eye large; gill rakers very long. Pectorals and ventrals well developed; dorsal long, inserted posteriorly, opposite anal, with no projecting neural spines before it; adipose fin rudimentary or obsolete; anal rays 25 or 30; caudal forked. Pseudobranchiæ well developed. No air bladder. Branchiostegals 8 or 9. Size small. (Named for Maurolico, an Italian naturalist.)

### 867. MAUROLICUS PENNANTI (Walbaum).

Head 3½; depth 4. D. 11 or 12; A. 11 + 18, the last rays very fine and not easily counted. Luminous spots occurring as impressions on the skin, not sitting on black globular bodies; twelve pairs of luminous spots along belly before ventrals; 9 in an upper series between pectorals and ventral , this series not continued backward; series from vent to caudal 1 + 14 + 8 = 23, with slight interruptions, the last spots close together; along shoulder girdle and isthmus 7; 7 about gill opening; 1 before eye and 2 behind it. Front of dorsal considerably nearer base of caudal than tip of snout, its last ray over origin of anal. Length 2½ inches. (Lütken; Günther.) Open seas, widely distributed, occasionally taken off the New England Coast. (Nahant, Provincetown, Woods Holl, etc.) (Named for Thomas Pennant, author of early works on Arctic Zoölogy and on the fishes of England.) (Eu.)

*Argentina pennanti*, Walbaum, Artedi Pisc., 47, 1792, England; after "Sheppy Argentine" of Pennant.

*Scopelus borealis*, Nilsson, Observ. Zool., 9, 1835, Norway.

*Maurolicus amethystino-punctatus*, Cocco, Lett. su. Salmon., 161, 1838, coast of Italy.

*Scopelus maurolici*, Cuvier & Valenciennes, Hist. Nat. Poiss., xxii, 439, 1849; after Cocco.

*Maurolicus mülleri*, Kröyer, Danmark's Fiske, iii, 113, 1838, Denmark.

*Scopelus humboldti*, De Kay, N. Y. Fauna: Fishes, 246, 1842.

*Maurolicus borealis* and *amethystino-punctatus*, Günther, Cat., v, 389, 390, 1864.

*Maurolicus pennanti*, Storer, Hist. Fishes Mass., 328, 1867; not of Cuvier; Lütken, Spolia Atlantica, ii, 47, 1892; Lilljebjorg, Sveriges Fiskar, vi, 10, 1889.

*Maurolicus borealis*, Jordan & Gilbert, Synopsis, 284, 1883.

## 271. VINCIGUERRIA, Jordan & Evermann.

*Vinciguerria*, Jordan & Evermann, new genus, (*attenuata*).

This genus is close to *Maurolicus*, from which it differs, according to Lütken, chiefly in the character of its luminous spots which are pearl-like and placed on black globular bodies. Anal short, of 14 rays. (Named for Dr. Decio Vinciguerra, director of the Acquario Romano, and one of the most active and scholarly of the naturalists of Italy.)

### 868. VINCIGUERRIA ATTENUATA (Cocco).

Head 3¾; depth 6. D. 12; A. 14. Last ray of dorsal just behind vertical from origin of anal. Luminous spots slightly prominent, "appearing as convex pearls, each sitting on a black globular body;" twelve to 14 pairs of spots between front of anal and base of caudal; upper row from gill opening to ventrals with 12, 11 between ventrals and anal; from tip of isthmus to anal, 7 + 16 + 10 = 33 spots. Length 2 inches. Open Atlantic, west to the Bahamas; in deep water. (Lütken, etc.) (*attenuatus*, slender.) (Eu.)

*Maurolicus attenuatus*, Cocco, Lett. su. Salmon., 33, 1838, coast of Italy; Günther, Cat., v, 390, 1864; Lütken, Spolia Atlantica, ii, 271, 1892.

*Scopelus tenorei*, Cuvier & Valenciennes, Hist. Nat. Poiss., xxii, 440, 1849; after Cocco.

## 272. VALENCIENNELLUS, Jordan & Evermann.

*Valenciennellus*, Jordan & Evermann, new genus, (*tripunctulatus*).

This genus is close to *Maurolicus* but with the dorsal fin farther back, opposite anal, its first ray nearly over front of anal. Photophores above anal gathered in about five clusters, each on a black background; anal fin long. Deep sea. (Named for Achille Valenciennes, the associate of Cuvier, author of the greater part of the "Histoire Naturelle des Poissons," a noble work which is the foundation of modern ichthyology.)

### 869. VALENCIENNELLUS TRIPUNCTULATUS (Esmark).

Head 3¾; depth 3¾. D. 9 or 10; A. about 24. Luminous spots arranged in and placed on black bodies, 16 pairs in the lower row from pectorals to ventrals, 5 between ventrals and anal; 5 black areas between vent and caudal about equidistant, and each one with 2 or 4 small luminous spots set close together (the first 3 with 3 each, the fourth with 2, and the last with 4); 1 spot on preopercle, 4 near shoulder girdle, 5 in an upper row behind pectoral; head and region along lateral line with a row of about 16 black pigment spots, some of them star-shaped, with many radiations, these largest posteriorly; large and small ones interspersed. First ray of dorsal slightly before first of anal. Length 2½ inches. Two specimens known, one from Madagascar and one from Denmark Straits, between Greenland and Iceland. (Lütken.) (*tripunctulatus*, three-spotted.)

*Maurolicus tripunctulatus*, Esmark, Christiania Vid. Selsk., Forh., 488, 1870, Madagascar; Lütken, Spolia Atlantica, Scopelini, 49, 1892.

## Family LXXVII. CHAULIODONTIDÆ.

### (The Viper-fishes.)

Body more or less elongate, covered with thin caducous scales, or sometimes naked; photophores present. Mouth large, the teeth irregular in size; maxillary entering margin of upper jaw. No pseudobranchiæ; interopercle rudimentary; gill openings wide. Dorsal and anal moderate or large. Deep-sea fishes of rather small size but voracious habits, some 7 genera and about 20 species known.

Gonostominæ:

- *a.* Opercles complete; dorsal inserted behind ventrals; teeth moderate, some of them enlarged or canine-like; gill rakers long.
  - *b.* Dorsal inserted on posterior half of body.
    - *c.* Dorsal inserted opposite anterior rays of anal; air bladder absent.
      - *d.* Scales present; adipose fin present; luminous spots large and conspicuous; no vomerine teeth; suborbital covering the cheek. Gonostoma, 273.
      - *dd.* Scales very caducous; adipose fin absent; suborbital not covering the cheek.
        - *e.* Dorsal rays about 20; photophores conspicuous. Bonapartia, 274.
        - *ee.* Dorsal rays 12 or 13; photophores small; vomerine teeth present. Cyclothone, 275.
  - *bb.* Dorsal nearly median in its position, inserted slightly in advance of anal, its posterior rays overlapping anterior rays of anal; body rather elongate; teeth in double rows in premaxillary and mandible; vomer with fangs. Yarrella, 276.

Chauliodontinæ:

- *aa.* Opercles incomplete, the interopercle rudimentary; both jaws with excessively long fang-like canines; dorsal inserted before ventrals; gill rakers none; scales large, thin, and deciduous. Chauliodus, 277.

### 273. GONOSTOMA, Rafinesque.

*Gonostoma*, Rafinesque, Indice Ittiol. Sicil., 64, 1810, (*denudatum*).

Body elongate, somewhat compressed, and probably all species provided with very large, thin, caducous scales; lower parts with series of luminous spots. Head conical; cleft of mouth very wide, oblique, extending behind eye, the lower jaw strongly projecting; maxillary long and slender, sickle-shaped, closely connected with the short premaxillary; upper jaw with a single series of rather large, sharp, close-set teeth, about every fourth one more or less longer than the rest, and directed slightly outward; lower jaw with similar teeth, subequal, directed forward, with a few canines in front; no teeth on vomer. Eye small. Gill openings very wide, the membranes free from the isthmus. Gill rakers numerous, long, and slender. Pseudobranchiæ none; branchiostegals about 9. No air bladder. Dorsal and anal well developed, inserted opposite each other, the anal the longer; adipose fin small; caudal forked, its peduncle long and slender. Deep-sea fishes of small size. (*γωνία*, angle; *στόμα*, mouth.)

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|---|---|
| *a.* Anal rays about 30. | DENUDATUM, 870. |
| *aa.* Anal rays about 20. | BREVIDENS, 871. |

### 870. GONOSTOMA DENUDATUM, Rafinesque.

Head 4; depth 5½. D. 14 or 15; A. 30 or 31; P. 11 or 12; V. 8; scales 36. Jaws heterodont, the intermaxillary being armed with 2, the maxillary with about 12 large, distinct teeth, the spaces between them being filled with very small teeth; lower jaw similarly armed with 10 or 11 large teeth. Entire cheek covered by the enormously enlarged infraorbital. (Günther.)

This species is common in the Mediterranean and the neighboring parts of the Atlantic, especially off Madeira. In 1881, it was trawled by the *Fish Hawk* off the New England Coast. It was also obtained by the *Albatross*, at station 2665, in 263 fathoms, and by the French expedition, in 590 fathoms, off the coast of Morocco, and off the Cape Verdes, in 230–290 fathoms. (Goode & Bean.) (*denudatus*, made naked.) (Eu.)

*Gonostoma denudata*, RAFINESQUE, Indice Ittiol. Sicil., 65, 1810, Palermo; GOODE & BEAN, Oceanic Ichthyology, 38, fig. 116, 1895.
*Gasteropelecus acanthurus*, COCCO, Giorn. Sc. Lit., No. 77, 1829, Italy.
*Gonostomus acanthurus*, COCCO, Lett. su. Salmon., 1838.

### 871. GONOSTOMA BREVIDENS, Kner & Steindachner.

Head 4; depth 6. D. 13 or 14; A. 18 or 19; V. 7. Body elongate, compressed. Eye equal to snout, and about ⅙ length of head; interorbital space about ⅘ diameter of eye. Mouth opening large, oblique, lower jaw projecting; upper jaw reaching back to the angle of the preoperculum, and convex on its lower edge. Intermaxillary, maxillary, and mandible provided with a single row of sharp teeth, unequal in size; tongue toothless; two stronger teeth near the symphysis of the lower jaw; on the palatines, and possibly upon the pterygoids, a few small, sharp-pointed teeth. Gill opening very wide; 12 short branchiostegals, a luminous dot at the base of each of the 8 anterior ones; no pseudobranchiæ; gill laminæ large. Probably the lower pharyngeal bones covered with teeth similar to those in the jaws but in several rows. The dorsal has its origin nearly midway between the ventral and the anal, and is composed of 13 or 14 rays; adipose fin thread-like; ventral in front of the middle of the body (not behind, as stated by Kner) with 7 rays, reaching to the vent; anal with from 17 to 19 rays, beginning under the last 3 or 4 rays of the dorsal, and the fin similar in height to the dorsal; caudal equal in length to that of the head from snout to preoperculum, and strongly forked; pectoral small, pointed, and nearly as long as the caudal. The thin, caducous scales with which the body is covered exhibit no radiating lines, but have simple, delicate, concentric rings. On either side 2 longitudinal rows of inconspicuous phosphorescent spots, surrounded with black pigment; the lower row near the line of the belly begins near the throat and ends at the origin of the anal. In the space from the pectoral to the ventral are 16 spots; between the ventral and the anal 11; the upper row commences with 2 large spots upon the suboperculum, and continues back to the caudal. Color dark gray; the back and belly silvery; all the fins whitish, uniform in color.

Specimens taken by the *Blake* from off Grenada in 161 and 461 fathoms, in the old Bahama Channel in 500 fathoms, and off Bequia in 458 fathoms; the original type from the open Atlantic. (Goode & Bean.) (*brevis*, short; *dens*, tooth.)

*Gonostoma brevidens*, KNER & STEINDACHNER, Sitzb. Akad. Wissensch. Wien, LXI, 1870, 443, Atlantic; GOODE & BEAN, Oceanic Ichthyology, 98, 1895.

## 274. BONAPARTIA, Goode & Bean.

*Bonapartia*, GOODE & BEAN, Oceanic Ichthyology, 102, 1895, (*pedaliota*).

Body oblong, compressed, slender behind, as in *Gonostoma*, covered with large cycloid scales, nearly equal in size. A continuous row of photophores on either side of the ventral line upon the lowest row of scales, extending from the anterior part of the lower jaw to the extremity of the base of the anal; others upon the caudal peduncle. Head much compressed, cleft of mouth very wide. Premaxillary short; maxillary long, curved, forming the entire margin of the upper jaw, extending to the angle of the preoperculum. Jaws armed with a single series of not very numerous, acicular teeth, uniform in size; minute teeth on the palatines and pterygoids. Eye moderate. Pectoral and ventral fins small; dorsal fin on the hinder half of the body, opposite the anterior portion of the anal; adipose fin absent; anal much longer and higher than dorsal; caudal (probably) subtruncate. Gill opening exceedingly wide, the branchial aperture extending nearly to the dorsal line on either side, and extending forward also to the symphysis of the lower jaw. Gill rakers very long. (Named for Charles Lucien Bonaparte, Prince of Canino, 1775–1840, "whose admirable work upon the fishes of Italy, one of the most essential of the older works in the ichthyologist's library, is full in its discussion of the fishes allied to the one now under discussion.")

### 872. BONAPARTIA PEDALIOTA, Goode & Bean.

Head 3½; depth 4½; eye 5. D. 20; A. 30; scales 46. Body elongate, compressed. Eye about equal to snout; width of interorbital space less than eye. Mouth large, oblique, the lower jaw slightly projecting; upper jaw reaching back to angle of the preopercle, and convex on its lower edge between the verticals from the anterior and posterior margins of the eye. Preopercle extending backward in a sharp angle. Origin of dorsal fin equidistant from root of ventral and the axil of posterior anal ray, and in vertical from fourth or fifth anal ray; greatest height of dorsal about equal to its base; origin of anal equidistant from the posterior margin of the orbit and base of middle caudal rays, its anterior third greatly prolonged, falcate in form; length of the longest or third ray about equal to length of base of fin; posteriorly to end of dorsal the fin is low; pectorals and ventrals short and feeble; ventrals inserted about midway between tip of snout and root of caudal fin. A single row of rather conspicuous phosphorescent spots from the lower jaw, beneath the eye, to end of anal on either side, these dots being heavily margined and with black above; 12 of these between branchial opening and the origin of ventral, 5 between ventral and anal, 16 in the anal series, and 2 upon caudal peduncle, 1 at origin of lower caudal rays, the other in vertical above it and about $\frac{1}{6}$ of the distance from the dorsal outline; a series of vertical, elongated spots, apparently phosphorescent, upon either side of the lower jaw, giving it a pectinate appearance. Color brownish gray; the head with silvery reflections.

The types of this species are two specimens, about 1 and 2 inches long respectively, obtained by the steamer *Albatross* from station 2642, at a depth of 217 fathoms. (*πηδăλιωτος*, having rudder-like fins.)

*Bonapartia pedaliota*, Goode & Bean, Oceanic Ichthyology, 102, fig. 120, 1895, Gulf Stream, at 25° 20′ 30″ N., 79° 58′ W. (Type, No. 44337. Coll. Albatross.)

## 275. CYCLOTHONE, Goode & Bean.

*Cyclothone*, Goode & Bean, Bull. Mus. Comp. Zoöl., x, No. 5, 1883, 221, (*lusca*).
*Sigmops*, Gill, Proc. U. S. Nat. Mus., 1883, 256, (*stigmaticus*).
*Neostoma*, Vaillant, Exp. Scient. Travailleur et Talisman, 86, 1888, (*bathyphilum*).

Body elongate, somewhat compressed, apparently devoid of scales; lower parts with inconspicuous series of luminous spots, with the latter arranged approximately as in *Gonostoma*, but usually much less conspicuous. Head conical, compressed; cleft of mouth very wide, oblique, extending behind the eye; the lower jaw strongly projecting. Maxillary long and slender, sickle-shaped; somewhat dilated posteriorly, but covering only an inconsiderable portion of the cheek. Upper jaw with a single series of needle-like teeth, some of which are enlarged; lower jaw with similar teeth, and in some species with a few canines in front; teeth on vomer sometimes in patches, sometimes reduced to a single pair of fangs; palatine and pterygoid teeth present or absent. Eye moderate, not conspicuous. Gill opening very wide, the membranes free from isthmus; gill rakers numerous, long and slender. Pseudobranchiæ none. No air bladder. Dorsal and anal moderate, opposite, the latter much the longer; adipose fin sometimes present. (*κύκλος*, round; *ὀθόνη*, veil.)

Cyclothone:
  *a*. Anal rays 18 to 22.
    *b*. Body not greatly elongate, the depth 7 to 8 in length. MICRODON, 873.
    *bb*. Body elongate, the depth 11 in length. BATHYPHILA, 874.
Sigmops (*σίγμα*, the letter s; *ὧψ*, appearance):
  *aa*. Anal rays 27 to 30; depth 7 in length. ELONGATA, 875.

### Subgenus CYCLOTHONE.

#### 873. CYCLOTHONE MICRODON (Günther).

Head 4⅔; depth 7⅔; eye as long as snout, 7 in head. B. 7 to 9; D. 11 or 12; A. 16 to 20; C. 17; P. 9 or 10; V. 5. Body elongate. Cheeks naked. Premaxillary very short, extending to vertical from posterior limb of anterior nostril; maxillary very strongly curved downward, with a short knob at its anterior extremity, not visible without dissection. Most of the teeth on maxillary inclined forward. Gill rakers 9+13 or 14. Lower jaw long, included, with the exception of the projecting tip. Eye circular, close to the profile, the interorbital area being very narrow; anal under second ray of dorsal, its base half as long again as that of dorsal, and nearly ⅓ as long as body; its outline resembling that of dorsal, its longest ray a little longer than the longest of the dorsal; caudal forked; pectoral inserted under tip of opercular flap, its length equal to greatest height of body; ventral inserted at a distance from snout equal to twice the length of the head, its length slightly exceeding that of the pectoral, 7 in body. Color blackish brown, the luminous pores inconspicuous, in a row on each side from pectoral region to tail, and another below it from throat to the origin of anal. (Goode & Bean.)

First obtained from great depths near Bermuda, subsequently at numerous localities in the Atlantic, Pacific, and Antarctic oceans, at depths of from 500 to 2,900 fathoms. Since also taken from numerous localities in the Atlantic by the *Albatross* and the *Blake*. It is equally abundant in deep water along the Pacific Coast from Oregon to the Galapagos. In fact it is everywhere one of the most widely distributed and common of all deep-sea fishes. "Although many hundreds of specimens are in the National Museum, the species is so exceedingly delicate and hard to preserve that not one of them gives satisfactory opportunity for study." (Goode & Bean.) (*μικρός*, small; *ὀδούς*, tooth.)

*Gonostoma microdon*, GÜNTHER, Ann. and Mag. Nat. Hist., II, 1878, 188, near Bermuda; GÜNTHER, Voy. Challenger, XXII, 175, 1887; LÜTKEN, Spolia Atlantica, Scopelini, 60, 1892.
*Cyclothone lusca*, GOODE & BEAN, Bull. Mus. Comp. Zoöl., X, No. 5, 1883, 221, Gulf Stream.
*Cyclothone microdon*, GOODE & BEAN, Oceanic Ichthyology, 990, fig. 114, 1895.

#### 874. CYCLOTHONE BATHYPHILA (Vaillant).

Head 4½; depth 11. D. 12 or 13; A. 21 or 22; V. 7; P. 10; branchiostegals 13. Body elongate, compressed; vent midway between tip of snout and end of caudal rays. Eye moderate, its diameter equal to half length of snout, and also to the width of interorbital space; placed far forward, so that the snout is very short, ¼ length of head. Cleft of mouth exceedingly wide, oblique. Maxillary somewhat dilated, but not covering any considerable portion of the cheek, its tip separated from the angle of the operculum by a distance greater than the diameter of the eye. Teeth of premaxillaries moderate in size; upon maxillaries and mandible larger, conical, separated by moderate intervals, which are filled with smaller teeth; teeth also on palatines, pterygoids, and pharyngeals. Opercular bones very thin. Origin of dorsal and anal fins opposite, immediately behind vent, the anal more than twice as long as the dorsal and reaching nearly to the tail, which is forked; adipose dorsal small; pectoral and ventral composed of weak rays, the origin of the latter nearly midway from base of pectoral to vent, and tips of longest rays reaching to vent. Branchial arches 4, long and slender; very elongate gill rakers, 10 + 15 in number, the longest twice as long as eye. Velvety black, with a number of luminous spots.

This species was obtained by the French explorers at depths of 710 to 1,290 fathoms in the Gulf of Gascony and off the Azores. It has since been found in considerable numbers in the western Atlantic by the *Albatross*. (Goode & Bean.) (βαθύς, deep; φιλέω, to love.) (Eu.)

*Neostoma bathyphilum*, VAILLANT, La Nature, 1884, 184; name and rough figure only.

*Cyclothone bathypila*, VAILLANT, Travailleur et Talisman, 96, pl. 8, figs. 1, 1*a*, 1888, Gulf of Gascony; Azores; GOODE & BEAN, Oceanic Ichthyology, 100, fig. 118, 1895.

### Subgenus SIGMOPS, Gill.

### 875. CYCLOTHONE ELONGATA (Günther).

Head 4½; depth 7. D. 13; A. 27 to 30; P. 11; V. 7. Vent midway between root of caudal fin and eye. Eye moderate, ⅔ of snout, about ⅛ length of head, its diameter less than width of interorbital space. Mouth exceedingly wide, maxillary extending to the posterior angle of the operculum, with a number of large teeth at considerable distances, with interspaces filled with smaller teeth; intermaxillary with 2, and mandible with about 10, large teeth. Infraorbital bone dilated, covering only about ½ of cheek; opercular bones thin. Gill laminæ short; gill rakers long; branchiostegals 11, very short. Dorsal fin inserted a little behind the vertical from vent, its greatest height exceeding that of the body at the point of its origin; anal fin directly under the dorsal, much longer, extending nearly to root of caudal, highest in front; pectoral narrow, slender, placed low, its length ⅔ that of the head; distance of ventral from vent contained ½ in its distance from pectoral. Scales have apparently been present, on a part at least, of the body, namely, the tail and ventral line. Luminous organs very pink, with silvery margins, in two rows on either side of the abdomen. Color black.

This species was obtained by the *Challenger* south of New Guinea, in 800 fathoms, and off Banda, in 360 fathoms. It has been found in considerable numbers in the deep waters off the American Coast by both the *Blake* and the *Challenger*, by the *Investigator* in the Indian Ocean, and by the *Albatross* in the Gulf Stream at station 2039 in 2,361 fathoms. (Goode & Bean.) (*elongatus*, elongate.)

*Gonostoma elongatum*, GÜNTHER, Ann. and Mag. Nat. Hist., II, 1878, 187, New Guinea; Banda.

*Sigmops stigmaticus*,* GILL, Proc. U. S. Nat. Mus., VI, 1883, 256, Gulf Stream, in 38° 19′ 26″ N., 68° 20′ 20″ W. (Type, No. 33291. Coll. Albatross.)

*Cyclothone elongata*, GOODE & BEAN, Oceanic Ichthyology, 101, fig. 119, 1895.

## 276. YARRELLA, Goode & Bean.

*Yarrella*, GOODE & BEAN, Oceanic Ichthyology, 103, 1895, (*blackfordi*).

Body elongate, compressed, covered with rather large, thin, deciduous scales; the lower parts with luminous spots. Head conical, compressed;

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* The type of *Sigmops stigmaticus* is an imperfect individual, from which the luminous spots had been rubbed off before it was examined.—*Goode & Bean.*

cleft of mouth very wide, oblique, extending behind the eye. Lower jaw strongly projecting. Intermaxillary comparatively long, forming about half of margin of upper jaw. Upper jaw with a single row of teeth in the maxillary, and a double row in the intermaxillary, interspersed with occasional stronger teeth; those in the intermaxillary directed downward or backward, those in the maxillary somewhat forward; mandible with double row of small teeth, outer row with some larger ones; a row of short, weak teeth on the palatines; head of vomer with a short fang on either side. Eye moderate; gill openings very wide, the membranes free from the isthmus. Gill rakers not very numerous, rather short and stout. Pseudobranchiæ none. Branchiostegals numerous, 14. No air bladder. Dorsal and anal well developed, the former far in advance, its posterior rays over the origin of anal; no adipose fin; caudal moderately forked. (Named for William Yarrell, 1789–1856, an eminent ichthyologist, who wrote on the fishes of England.)

### 876. YARRELLA BLACKFORDI, Goode & Bean.

Head 4½; depth 7½; eye 7. D. 15; A. 27; V. 6. Body elongate. Eye moderate, its diameter ⅔ of snout; maxillary extending far behind the eye, its length equal to that of postorbital part of the head. Gill rakers 6 + 13, the longest about as long as the eye. Branchiostegals 14. Dorsal origin a little nearer root of caudal than tip of snout, nearly over middle of space between ventral and anal, its posterior ray over seventh ray of anal; distance of ventral origin from tip of snout contained 2⅓ times in total (without caudal), its rays imperfect, the longest only about ¼ length of head; pectoral placed low, on a narrow base. Scales have evidently been present, and of considerable size, but their character and number can not be ascertained from the specimens examined.

Color purplish brown; 9 phosphorescent spots on the isthmus, 25 between the symphysis of the mandible and the root of ventral, 12 between the origin of ventral and vent, and 26 from vent to tail; a second row of pearly spots extends from above root of pectoral to origin of anal.

The type obtained by the *Albatross* from station 2376, at a depth of 324 fathoms. Two other specimens, the larger one 9½ inches in length, taken at the same place. (Named for Eugene G. Blackford, president of the board of fish commissioners of the State of New York.)

*Yarrella blackfordi*, GOODE & BEAN, Oceanic Ichthyology, 103, fig. 121, 1895, Gulf Stream at 29° 03′ 15″ N., 88° 16′ W. (Type, No. 44242. Coll. Albatross.)

## 277. CHAULIODUS, Bloch & Schneider.

(VIPER-FISHES.)

*Chauliodus*, BLOCH & SCHNEIDER, Syst. Ichth., 430, 1801, (*sloanei*).
*Leptodes*, SWAINSON, Nat. Hist. Anim., II, 298, 1839, (*sloanei*).

Body elongate, compressed, covered with very thin deciduous scales of moderate size; lower side of head, body, and tail with series of luminous spots. Head short, much compressed and elevated, the bones thin but ossified; lower jaw projecting, the snout much shorter than eye; mouth extremely wide, the cleft reaching much beyond eye; premaxillaries with 4 long, fang-like canines on each side; mandible with pointed, wide-set teeth, the anterior ones excessively long; none of these large teeth received within the mouth; maxillaries with fine teeth; palatine with a single series of small pointed teeth; no teeth on the tongue. Opercle very narrow, the interopercle rudimentary. Eye moderate. Pectorals moderate; ventrals large; dorsal fin high, placed anteriorly, well in front of the ventrals; adipose fin moderate, sometimes fimbriate, opposite the low, short anal; caudal moderate, forked. Gill openings very wide; no gill rakers. Branchiostegals numerous; no pseudobranchiæ. Deep-sea fishes of voracious habits; two species known. (*χαύλιος*, exserted; *ὀδούς*, tooth.)

*a.* Head 7 in length; Atlantic species. SLOANEI, 877.
*aa.* Head 6 in length. Pacific species. MACOUNI, 878.

### 877. CHAULIODUS SLOANEI, Bloch & Schneider.

Head 7; depth 7. B. 17; D. 6; A. 12; V. 7; scales 56 (65 in a figure published by Agassiz in Cruise of the *Blake*). Dorsal not far backward, its distance from occiput less than length of head, its first ray produced in a long filament nearly ⅓ length of body; pectoral fins short; ventral fins long, longer than head, and much longer than pectorals. About 30 luminous dots in a series from the chin to the ventrals. Scales of the body subhexagonal. Head nearly as deep as long. Greenish above; sides silvery; belly blackish. Length 12 inches. (Günther.) Mediterranean and deep waters of the Atlantic; a specimen found in the stomach of a cod on George's Banks; and elsewhere in deep water; also in the Mediterranean. (Named for Hans Sloane, an early naturalist and traveler, who wrote on the animals of Jamaica.) (Eu.)

*Chauliodus sloanei*, BLOCH & SCHNEIDER, Syst. Ichth., 430, 1801, Atlantic; after Vipera Marina of CATESBY; GÜNTHER, Cat., V, 392, 1864; JORDAN & GILBERT, Synopsis, 285, 1883.
*Chauliodus setinotus*, BLOCH & SCHNEIDER, Syst. Ichth., pl. 85; same type.
*Esox stomias*, SHAW, Gen. Zoöl., V, 120, 1804; after CATESBY.
*Chauliodus schneideri*, RISSO, Europe Mérid., III, 442, 1826, Nice.

### 878. CHAULIODUS MACOUNI, Bean.

Head 6; eye 4½; snout 4½. D. 6; A. 11; V. 7; P. 13; scales 56. Longest fang in mandible nearly half head. Dorsal beginning over seventh row of scales, its first ray 3½ to 4½ in body, its base 3 in head; base of adipose dorsal ⅔ that of anal, which is more than half head; ventral 5 in body, inserted under seventeenth scale of lateral line. Coast of California to British Columbia, in deep water; the type taken off Queen Charlotte Islands, in 876 fathoms; about 4 specimens known; close to *C. sloanei*, the head a little longer, the scales perhaps larger; probably not distinct. (Named for Prof. John C. Macoun, of the Geological Survey of Canada.)

*Chauliodus macouni*, BEAN, Proc. U. S. Nat. Mus., 1890, 44, off Queen Charlotte Islands, at Albatross Station 2860, at 51° 23′ N., 130° 34′ W. (Type, No. 45372. Coll. Albatross.)

## Family LXXVIII. ASTRONESTHIDÆ.

Stomatoid fishes, with adipose dorsal present, and with scaleless body. Dorsal fin inserted behind vent, but in front of anal. A single genus, with few species; fishes of the deep sea. (*Astronesthidæ*, Gill, in Goode & Bean, Oceanic Ichthyology, 105, 1895.)

### 278. ASTRONESTHES, Richardson.

*Astronesthes*, Richardson, Ichth. Voy. Sulph., 97, 1845, (*niger*).
*Phænodon*, Lowe, Proc. Zoöl. Soc. Lond., 1850, 250, (*ringens*).

Body rather elongate, compressed, scaleless. Head compressed, the snout of moderate length, the mouth wide, lower jaw prominent. Teeth pointed, unequal; upper jaw with 4 long, curved canines; front of lower with 2; maxillary teeth fine, subequal; palatines with a single series of small, pointed teeth, similar to those on tongue. Eye moderate, not longer than snout. Throat with a long fleshy barbel. Dorsal fin rather long, inserted entirely in front of anal, behind ventrals; adipose fin present; caudal forked; paired fins long. Gill rakers minute. No pseudobranchiæ. No air bladder. Sides and belly with very many small luminous spots; a small luminous patch below eye. Small fishes of the deep seas; remarkable for their strong teeth, the lower jaw much stronger than in *Malacosteus*; 4 species known. (*ἄστρον*, star (starfish); *ἐσθίω*, to eat.)

*a*. Barbel not much longer than head; last ray of dorsal considerably behind vent, nearly over first ray of anal.
  *b*. D. 17; A. 14. NIGER, 879.
  *bb*. D. 17; A. 17. GEMMIFER, 880.
*aa*. Barbel much longer than head; last ray of dorsal in advance of vent, and much before first ray of anal. RICHARDSONI, 881.

#### 879. ASTRONESTHES NIGER, Richardson.

Head 4⅓; depth 5½; eye 4⅔. D. 17; A. 14; V. 30 + 15 = 45. Body rather stout, deepest at the nape. Barbel a little longer than head. Dorsal beginning just behind base of ventrals, its last ray considerably behind vent and nearly over first of anal; pectoral not reaching nearly to ventrals. Jaws subequal. Eye large, well forward, almost as long as snout, the luminous spot below it very small. Color black, with 22 photophores between chin and ventral. Deep waters of all seas. One specimen taken in the open sea off our coast.* (*niger*, black.)

*Astronesthes nigra*, Richardson, Ichth. Voy. Sulphur, 97, 1845, **Atlantic**; Günther, Cat., v, 425, 1864; Lütken, Spolia Atlantica, II, 537, 1892; Jordan & Gilbert, Synopsis, 287, 1883.

*Stomias fieldii*, Cuvier & Valenciennes, Hist. Nat. Poiss., XVIII, 378, 1846, **Mid-Atlantic.** (Type, No. 34538. Coll. Capt. Field.)

*Phænodon ringens*, Lowe, Proc. Zoöl. Soc. Lond., 1850, 251, **Madeira.**

*Astronesthes barbatus*, Kner, Sitzber. Akad. Wiss. Wien, 1860, XXXIX, 543, **Coast of Brazil.**

#### 880. ASTRONESTHES GEMMIFER, Goode & Bean.

Head 4½; depth 5½; eye 4. D. 17; A. 17; V. 7; P. 9. Barbel about equal in length to the head. Origin of dorsal fin a little nearer tip of

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*This species is represented in the national collection by only a single specimen (No. 34538, U. S. National Museum), the type of *Chauliodus fieldii*, Cuvier & Valenciennes, obtained by Captain Field, in May, 1819, on a voyage from Mogador to New York, probably at the surface. This specimen passed from the hands of Dr. Mitchill to those of Mr. J. Carson Brevoort, then to Mr. E. G. Blackford, by whom it was presented to the National Museum. (Goode & Bean.)

snout than root of caudal; length of its base contained nearly 4 times in the total without caudal, its longest ray ⅔ length of head. Ventral origin directly under dorsal origin; length of ventral 5½ times in body, not reaching nearly to vent; distance of anal origin from root of the caudal a little more than ¼ of total length without caudal. Eye longer than snout. Pectoral nearly ⅐ as long as body without caudal.

The type of this species, about 7½ inches in length, was taken from a halibut's stomach, January 26, 1890, by the schooner *Polar Wave*, in 44° 25′ N. latitude, 53° 12′ W. longitude, in about 300 fathoms. This species may possibly prove identical with *A. niger*. The limits of variation of the fin rays in this genus have not been determined for lack of sufficient material. The specimen has 17 anal rays and numerous gem-like dots on the lower part of the body, there being about 30 in the series from the symphysis of the mandible to the ventral. (Goode & Bean.) (*gemma*, bud or gem; *fero*, I bear.)

*Astronesthes gemmifer*, Goode & Bean, Oceanic Ichthyology, 105, fig. 124, 1895, Grand Banks. (Type, No. 24645. Coll. Schr Polar Wave.)

### 881. ASTRONESTHES RICHARDSONI (Poey).

Head 4½; depth 6⅔; eye 7. D. 12 or 13; A. 13 or 14. Body more elongate than in *A. niger*, less rapidly tapering backward; barbel much longer than head, reaching beyond tip of pectorals; dorsal beginning over axil of ventrals, its last ray in advance of vent and far in advance of first of anal; pectorals almost reaching ventrals; lower jaw prominent; eye small, shorter than snout, the luminous organ below it as long as pupil. Black, with the usual many luminous spots. Deep waters of West Indies, Indian and Pacific oceans. (Lütken.) (Named for Sir John Richardson, the discoverer of the genus *Astronesthes*.)

*Chauliodus richardsoni*, Poey, Memorias, I, 176, 1855, Cuba. (Coll. Poey.)

*Astronesthes richardsoni*, Günther, Cat., v, 425, 1864; Lütken, Spolia Atlantica, II, 55, 1892.

## Family LXXIX. STOMIATIDÆ.

Body elongate, tapering, naked or covered with very thin and deciduous scales. Head oblong; snout short and rounded. Eyes large and far forward. Opercular apparatus imperfectly developed. Mouth enormous, with deep lateral cleft; lateral margin of upper jaw formed by maxillary and provided with teeth along the edges; teeth usually strong, unequal, some of them often fang-like or barbed. Gill membranes not joined, free from the isthmus. Branchiostegals numerous (12 to 17); a long barbel at throat. No pseudobranchiæ. Dorsal fin short, median or posterior, without spines; anal free, far behind and small; caudal distinct; pectorals low down on the scapular arch and narrow; ventrals inserted far backward. Stomach cæcal, and pyloric appendages absent. Sides with phosphorescent spots. Skeleton feebly ossified. Eggs excluded through oviducts. (Goode & Bean.) Deep sea-fishes of extremely voracious habits; 8 genera and about 20 species known. (*Stomiatidæ*, part, Günther, Cat., v, 424, 1864.)

Stomiatinæ:

- *a.* Pectorals present.
  - *b.* Body covered with fine scales; ventrals very far back. Stomias, 279.

*bb.* Body naked.

*c.* Pectorals with separate ray; vomer with teeth; teeth in jaws long, depressible; palatines with teeth. ECHIOSTOMA, 280.

*cc.* Pectorals normal; vomer toothless; dorsal and anal similar in size and opposite; teeth fang-like; pigment spots in place of lateral line; eye small. GRAMMATOSTOMIAS, 281.

PHOTONECTINÆ:

*aa.* Pectorals absent; body naked; dorsal inserted behind vent. PHOTONECTES, 282.

## 279. STOMIAS, Cuvier.

*Stomias*, CUVIER, Règne Animal, Ed. 1, 184, 1817, (*boa*).

Body elongate, compressed, covered with exceedingly fine, deciduous scales, which are scarcely imbricated, lying in subhexagonal depressions in the skin. Head compressed, the snout very short and the cleft of the mouth extremely large. Mouth oblique, the lower jaw projecting. Teeth pointed, unequal, those of the premaxillaries and mandible very large; maxillary with fine teeth; vomer with a pair of fangs; palatines and tongue with smaller pointed teeth. Eye moderate. Opercular portion of the head short; a large fleshy barbel suspended from the hyoid region. Vent far back. Dorsal comparatively long, far back, opposite the anal; pectorals and ventrals rather small and short, the latter far back; caudal fin moderate. Lower side of head, body, and tail with series of luminous spots. Gill openings very wide; no pyloric cœca. Singular fishes of the deep sea; 3 species now known. (*stomias*, "mouthy," from *στόμα*, mouth.)

*a.* Head 10 times in length of body; ventrals not produced. FEROX, 882.

*aa.* Head 8 times in length of body; ventrals much produced. AFFINIS, 883.

### 882. STOMIAS FEROX, Reinhardt.

Head 10; depth 12. D. 17; A. 21; P. 6; V. 6. Barbel longer than head, tapering and not fringed at tip. Pectorals and ventrals not produced; caudal rounded. Color black. (Günther.) Greenland and southward; abundant in deep waters of the Gulf Stream from Bahama Channel to the Grand Banks in 500 to 600 fathoms. (*ferox*, ferocious.)

*Stomias ferox*, REINHARDT, Vidensk. Selsk. Naturv., etc., x, 77, 1842, Greenland; GÜNTHER, Cat., v, 426, 1864; JORDAN & GILBERT, Synopsis, 286, 1883; GOODE & BEAN, Oceanic Ichthyology, 107, 1895.

### 883. STOMIAS AFFINIS, Günther.

Head 8; depth 12. D. 17; A. 20. Scaleless, but the hexagonal divisions of the skin distinct. Teeth fixed. Barbel about as long as head, ending in 3 filaments; end of stem of barbel white, probably luminous, and with a black pigment spot. Pectorals and ventrals narrow and elongate, the ventrals ending in a filament reaching beyond front of anal; anal higher than dorsal. Each of the abdominal series of photophores with 43 spots between pectoral and ventral; 6 between ventrals and anal, and 15 or 16 between front of anal and caudal; a parallel series runs below, and a third above middle of side of body. Fins white; dorsal, anal, and ventral with black margins. One specimen taken south of Sombrero Islands, in 450 fathoms. (Günther.) (*affinis*, related.)

*Stomias affinis*, GÜNTHER, Deep-Sea Fishes, Challenger, XXII, 205, pl. LIV, fig. A, 1887, Sombrero Islands, West Indies.

## 280. ECHIOSTOMA, Lowe.

*Echiostoma*, LOWE, Proc. Zoöl. Soc. Lond., 1843, 87, (*barbatum*).
*Hyperchoristus*, GILL, Proc. U. S. Nat. Mus., 1884, 256, (*tanneri*).

Body elongate, compressed, scaleless. Head rather compressed, the snout short and the cleft of the mouth very wide. Teeth pointed, more or less unequal, those of the premaxillary and the front of the lower jaw being longest; maxillary teeth in a single series, those of the lower ⅔ being small; teeth of the hinder part of the mandible in double or triple series; vomer with a pair of fangs; palatines with a single series of small pointed teeth, two groups of similar teeth on the tongue. Eye of moderate size. Opercular portion of the head very narrow and flexible; a fleshy barbel on the center of the hyoid region. Dorsal fin far back, opposite anal; caudal forked; vent not far in advance of caudal fin; pectorals and ventrals feeble, the latter behind the middle of the body. Series of luminous spots along the lower side of the head, body, and tail, the largest luminous organ placed behind eye along maxillary, longer than eye; a smaller eye-like one, in suture between opercle and interopercle. Gill openings very wide. Gill rakers minute. No pseudobranchiæ nor air bladder. Atlantic. (*ἔχις*, a viper; *στόμα*, mouth.)

*a*. Anal rays 16 to 18; teeth of jaws large, unequal. BARBATUM, 884.
*aa*. Anal rays 24; teeth of jaws small, subequal. MARGARITA, 885.

### 884. ECHIOSTOMA BARBATUM, Lowe.

Head 6; depth 9. B. 12; D. 12 to 15; A. 16 to 18; P. 3 to 5; V. 8. Barbel as long as head, fringed at its tip. Upper ray of pectoral produced in a long and slender filament reaching nearly to the root of the ventrals; ventrals narrow, elongate. Color black, with elongate, club-shaped, luminous spot between the maxillary and the eye, rose-colored in life. Length 9 inches. Deep waters off Madeira; also taken off Gloucester, Massachusetts, and southward in the Gulf Stream to the Old Bahama Channel. (*barbatus*, bearded.)

*Echiostoma barbatum*, LOWE, Proc. Zoöl. Soc. Lond., 1843, 88, Madeira; GÜNTHER, Cat., v, 427, 1864; GOODE & BEAN, Bull. Essex Inst., 1879, 23; JORDAN & GILBERT, Synopsis, 287, 1883; GÜNTHER, Deep-Sea Fishes, Challenger, 206, 1887.

*Hyperchoristus tanneri*, GILL, Proc. U. S. Nat. Mus., 1883, 256, Gulf Stream, at Albatross Station 2083, at 40° 26′ 40″ N., 60° 58′ W., in 956 fathoms. (Type, No. 33444. Coll. Albatross.)

### 885. ECHIOSTOMA MARGARITA, Goode & Bean.

Head 8; depth 8; eye 8. D. 18; A. 24; V. 7. A stout barbel behind from the tip of the lower jaw, somewhat more than ½ length of head; at the extremity, this barbel is divided into 6 fringes, one of which is whitish; a whitish band on the barbel near the root of the fringes. About 31 teeth on each side of upper jaw and 36 on each side of mandible; none of the teeth in the jaws being enlarged; vomer with a pair of depressible fangs on right side and a single one on the left; five depressible teeth on each palatine; lingual teeth in about 4 rows. Length of upper jaw ⅘ length of head. Mandible nearly as long as head. Eye equal to snout and ⅕ as long as upper jaw. Mandible projecting beyond upper jaw when the mouth is closed, a distance equal to ½ the eye. Nostrils about midway between eye and tip of snout. Gill laminæ all well developed, increasing in size backward, not entirely concealed by the opercular bones. Gill rakers minute scattered spines. Distance of vent from base of caudal 6⅐ times in the total length; anal beginning immediately behind vent and extending nearly to base of tail; dorsal immediately over anal; the sixth and longest ray of ventral ⅚ length of head; pectorals of both sides have been torn off in the type. Two rows of minute photophores similar to those in *E. barbatum* and similarly situated. Pearl-colored spot above the maxilla, beginning at the hind margin of the eye; its length about ⅜ that of the eye. Color very dark, inside of the mouth black. Middle of the Gulf of Mexico in 420 fathoms. The single type is in bad condition. There is no doubt that the species is distinct from *Echiostoma barbatum*, as it has very small subequal teeth. Length 13½ inches. (Goode & Bean.) (*μαργαρίτης*, pearl.)

*Echiostoma margarita*, GOODE & BEAN, Oceanic Ichthyology, 109, fig. 131, 1895, Gulf of Mexico. (Type, No. 39292. Coll. Albatross.)

### 281. GRAMMATOSTOMIAS, Goode & Bean.

*Grammatostomias*, GOODE & BEAN, Oceanic Ichthyology, 110, 1895, (*dentatus*).

Similar in general appearance to *Echiostoma*. Head short, compressed. Body compressed, moderately elongate. Dorsal and anal with numerous rays, placed opposite each other and close to the root of the caudal; ventrals in advance of the middle of the body, at a great distance from the vent; pectorals placed near the abdominal outline, consisting of a short filament very slightly separated from the rest of the fin, and several rays connected by a membrane. Two rows of minute phosphorescent spots on the body similar to those in *Echiostoma*. A very long and slender hyoid barbel. Mandibular teeth very unequal in size, comparatively few in number, arranged in 2 rows, an outer row of fixed teeth and an inner row of depressible ones; the first pair, near tip of mandible, very greatly enlarged and passing outside of the upper jaw when the mouth is closed. Premaxillary teeth uniserial or nearly so, the edge of the bone posteriorly with minute cirri; a pair of small, fixed, curved fangs in front, followed by a pair of larger movable ones; vomer toothless; palatines with several weak teeth; no lingual teeth. Upper pharyngeals present. A pearl-colored spot on cheek, similar to that in *Echiostoma*. Four gills, a short, narrow slit behind the fourth; gill rakers not numerous, short, spine-like; gill laminæ increasing in size backward. A series of pigment cells along the median line of the body, so arranged as to simulate a lateral line. Eye small, caudal lobes apparently unequal. Skin naked, its whole surface sprinkled with minute raised pigment spots, each with a light center. (*γράμμα*, a line; *Stomias*.)

#### 886. GRAMMATOSTOMIAS DENTATUS, Goode & Bean.

Depth 7; eye 5, as long as snout. D. 20; A. 24; V. 7; P. 1+3; C. 17. Upper jaw long and slender, its length 6½ times in the total; length of mandible 5⅝ times in the total; nostrils a little nearer eye than to tip of snout; maxillary and premaxillary closely welded, their separation marked by a changing in the character of the teeth, those on the maxillary being minute cirri. The large fangs in the tip of the mandible 2/7 length of upper jaw; hyoid barbel placed at a distance from the symphysis of the mandible, which is about equal to the enlarged fangs of the mandible, or 1/5 length of mandible; length of the barbel nearly 1/3 of total; pectoral close behind the head and near ventral outline, its first ray distinct from the other three, although placed close to them, and not produced; length of the pectoral 4 in head; ventrals in advance of middle of body, their distance from origin of pectorals ½ as great as from caudal base, their longest ray nearly equal to greatest height of body; distance of dorsal origin from caudal base 5¼ in total length; longest dorsal ray in middle of fin, half as long as longest of ventral; base of anal slightly longer than that of dorsal, its longest ray about ¾ as long as the longest dorsal ray; caudal lobes in type unequal, the lower one being much longer than the upper (perhaps result of accident.) Two rows of luminous spots, one close to the ventral outline, which becomes obsolete before it reaches the origin of the anal, and another in the lower third of height of body, which becomes indistinct about the middle of total length; 14 of these spots between pectoral and ventral in the lower series and 11 in upper series. One specimen, 6½ inches long, taken by the *Albatross* at station 2565, N. latitude 38° 19′ 20″, W. longitude 69° 02′ 30″, from 2069 fathoms. (Goode & Bean.) (*dentatus*, toothed.)

*Grammatostomias dentatus*, GOODE & BEAN, Oceanic Ichthyology, 110, fig. 133, 1895, Gulf Stream. (Type, No. 37370. Coll. Albatross.)

## 282. PHOTONECTES, Günther.

*Lucifer*, DÖDERLEIN, Wiegm. Archiv. f. Naturgeschich., 1882, 26, (*albipinnis*), (name preoccupied in Crustacea).

*Photonectes*, GÜNTHER, Challenger Report, XXII, 212, 1887, (*albipinnis*).

Body compressed, rather long, scaleless; vent far behind the middle of the length. Head compressed, with short snout and exceedingly wide mouth. Teeth in the jaws small, unequal in size, in single series; vomer and palatine with a small group of teeth on each side. Eye small. Opercular portion of the head very narrow. A long hyoid barbel. The dorsal fin opposite the anal, which commences behind the vent; pectorals none; ventrals inserted behind the middle of the length. A small suborbital phosphorescent organ, and 2 series of luminous dots along the lower part of the sides, with numerous rudimentary similar organs scattered over the skin of the body. (φώς, light; νήκτης, swimmer.)

### 887. PHOTONECTES GRACILIS, Goode & Bean.

Head 8½; depth 15½; eye 4. D. 18; A. 21; V. 7. Much more slender than the Japanese species, *P. albipinnis*. Type in very poor condition. Hyoid barbel remarkably short and probably imperfect. Fins incomplete, and the luminous dots along the sides so indistinct as to be made out only with great difficulty. The greatest depth of the head equal to length of its postorbital portion; snout very short, nearly half eye. Below and behind the eye there is a luminous body, which is nearly as long as the eye and somewhat club-shaped; at margin of operculum there is a small, roundish, luminous dot. Maxillary a very thin and narrow bone, extending backward almost to the end of the head, very slightly curved and forming a very obtuse angle with the short premaxillary; mandible very strongly curved upward, like a sled runner, its length twice greatest height of body. Both jaws armed with numerous fine teeth of unequal size; only 3 remain on each side of the premaxillary; maxillary with 20 true teeth on its anterior half, the posterior half with about 16 serræ; about 35 teeth on each side of mandible; all the teeth of jaws rake inward and backward, and are depressible; 3 teeth on each side of the head of the vomer, increasing in size backward; a pair of teeth on each palatine; 1 fang near the tip of the tongue and 3 farther back. Gill laminæ not well covered by the operculum; gill rakers very few, minute and spine-like; gill opening very wide, the membrane cleft almost down to origin of hyoid barbel. No pseudobranchiæ. Hyoid barbel situated nearly under tip of tongue, evidently imperfect, its length scarcely ½ that of eye. Longest dorsal ray a little longer than eye; anal beginning immediately under the dorsal, its base slightly longer than that of dorsal, its rays about as long as those of dorsal; distance of ventral from tip of snout a little more than ½ body; origin of ventral very slightly nearer root of caudal than tip of snout; pectoral wanting. Color very dark; a row of luminous dots along margin of branchiostegal membrane; two rows beginning on the isthmus and extending back along edge of belly, passing between ventrals and slightly above base of anal, disappearing near end of body; another row higher up on side, which can not be traced back farther than the ventral, on account of the bad condition of the specimen. Only the type known. Length 7 inches. (Goode & Bean.) (*gracilis*, slender.)

*Photonectes gracilis*, Goode & Bean, Oceanic Ichthyology, 112, fig. 137, 1895, off Martinique, at Blake Station XL, in 472 fathoms. (Coll. Str. Blake.)

## Family LXXX. MALACOSTEIDÆ.

Body elongate, compressed, scaleless. Mouth immense. Snout very short. Cleft of the mouth exceedingly wide, the ends of the jaws extending beyond the root of the pectorals, and the jaws not connected with the sides of the head back of the orbit. Tail diphycercal. Lateral margins of the upper jaw formed by the premaxillaries only. No adipose fin; pectorals rudimentary. No barbel, but a strap-shaped elastic band connecting the symphysis of lower jaw with the isthmus. (Goode & Bean.) Deep sea. Two species known; among the most remarkable known forms.

### 283. MALACOSTEUS, Ayres.

*Malacosteus*, Ayres, Journ. Bost. Soc. Nat. Hist., 1849, 53, (*niger*).

Body elongate, compressed, scaleless, deepest at the head and tapering backward. Head rather compressed, the snout extremely short; jaw bones and preopercles greatly prolonged, forming an enormous gape, extending to behind the root of the pectorals and large enough to permit the swallowing of fishes much larger than itself. Teeth pointed, unequal, in single series on both jaws and tongue; none on the palate. Eye very large, at very tip of the blunt snout, with two luminous organs below it, the anterior larger and pear-shaped, with the narrow end forward; sides with luminous spots. Hyoid barbel wanting; a cylindrical muscular band in its place connecting the symphysis of the very thin lower jaw with the front of the hyoid bone. This is probably contractile, "serving to give the extremity of the mandible power of resistance when the fish has seized its prey, as without such a contrivance so long and slender a bone would yield to the force of the struggling victim." * This structure is unique among fishes. No gill rakers. Two species known, in the deep seas. (*μαλακός*, soft; *ὀστέον*, bone.)

### 888. MALACOSTEUS NIGER, Ayres.

Head 3⅝; depth, 5½. D. 19; A. 20; P. 5; V. 6. Lower jaw with unequal canines, four of them fang-like and longer than the others. Pectoral rays filamentous. Ventrals filamentous, inserted midway between base of caudal and posterior luminous organ. Black, except the luminous spots. (Günther.) Open sea, in very deep water; rare. Known from the Gulf Stream and southward to Barbadoes. (*niger*, black.)

*Malacosteus niger*, AYRES, Journ. Bost. Soc. Nat. Hist., 1849, 53, Gulf Stream, 42° N. 60° W.; GÜNTHER, Cat., v, 428, 1864; JORDAN & GILBERT, Synopsis, 287, 1883; GÜNTHER, Deep-Sea Fishes Challenger, XXII, 214, 1887; GOODE & BEAN, Oceanic Ichthyology, 114, 1895.

## Family LXXXI. ALEPISAURIDÆ.

### (THE LANCET FISHES.)

Body elongate, rather compressed, scaleless. Head compressed, with the snout much produced, and with the cleft of the mouth very wide. Premaxillaries very long and very slender, forming the entire margin of the upper jaw, not protractile; maxillary thin, needle-like, as long as the premaxillary, immovable, provided with a small supplementary bone. Teeth very unequal, immovable, and subject to many variations in the same species; a series of small teeth the entire length of the premaxillary, those in front sometimes larger and curved; palatine teeth compressed, triangular, pointed, two or three of the anterior ones exceedingly long and strong, fang-like, the posterior ones moderate; teeth of the lower jaw similar to those on the palatines, one pair in front and two or three pairs in the middle being much enlarged; no teeth on the tongue. Eye large. Gill openings very wide; the gill membranes not united, free from the isthmus; gill rakers stiff, shortish, spine-like. Branchiostegals mostly 7. Pseudobranchiæ large. Opercular bones thin, membranaceous. Dorsal fin very long and high, occupying nearly the whole of the back, of more than 40 rays, which are slender and simple, all of them depressible into a deep groove, the fin invisible when depressed; ventral fins abdominal, nearly median, of 9 to 13 rays, the first ray simple, spine-like; adipose fin present, moderate; anal fin moderate; caudal fin forked. Air bladder none. Vertebræ about 50. A system of abdominal ribs symmetrically arranged along the whole length of abdomen to front of anal fin. Large fishes of the deep seas, found in the Atlantic and Pacific. Species about 10, usually referred to 1 genus. Every part of the body is so fragile that it is extremely difficult to procure specimens. The structure of the dorsal fin is so delicate that it must be liable to injury even in the water; the bones are very feebly ossified, and the fibrous ligaments connecting the vertebræ are very loose and extensible, so that the body may be considerably stretched. "This loose connection of the single parts of the body is found in numerous deep-sea fishes, and is merely the consequence of their withdrawal from the pressure of the water to which they are exposed in the depths inhabited by them. When within the limits of their natural haunts the osseous, muscular, and fibrous parts of the body will have that solidity which is required for the rapid and powerful movements of a predatory fish. That fishes of this genus (*Alepisaurus*) belong to the most ferocious of the class is proved by their dentition and the contents of their stomach, but it is worthy of notice that although the mouth is so deeply cleft, the lower jaw can not be moved from the upper at a greater angle than about 40°." These fishes have never been taken in the deep-sea dredge or trawl. Most of the specimens known have been cast up by storms or else taken on deep-sea lines. (Günther.) (*Scopelidæ*, group *Alepidosaurina*, Günther, Cat., v, 420–423, 1864.)

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*See Günther, Deep-Sea Fishes, Challenger, XXII, 212, 1887, for a full account of the structure of this remarkable type of fishes.

## 284. ALEPISAURUS, Lowe.

### (Lancet Fishes.)

*Plagyodus** (Steller MS.) Pallas, Zoogr. Ross.-Asiat., III, 383, 1811, (nonbinomial), (*æsculapius*, no specific name.)

*Alepisaurus*, Lowe, Proc. Zoöl. Soc. London, 1833, 104, (*ferox*).

*Caulopus*, Gill, Proc. Ac. Nat. Sci. Phila., 1862, 128, (*altivelis*).

*Plagyodus*, Günther, Ann. Mag. Nat. Hist., 1867; after Pallas.

*Alepidosaurus*, (corrected orthography).

Characters of genus included above. (*ἀ*, privative; *λεπίς*; *σαῦρος*, *Saurus*.)

Alepisaurus:
- *a.* Ventral fins rather small, of 8 to 10 rays; dorsal rays 39 to 44.
  - *b.* First ray of ventral serrated; pectorals elongate; dorsal rays 31 to 44. ferox, 889.
  - *bb.* First ray of ventral not serrated; pectorals about $1\frac{1}{3}$ in head; dorsal rays 36 to 39. æsculapius, 890.

Caulopus (*καυλός*, stem; *πούς*, foot, the ventral of many rays):
- *aa.* Ventral fins rather large, of about 13 rays.
  - *c.* Dorsal rays 40, the fin high; ventrals shorter than head. altivelis, 891.
  - *cc.* Dorsal rays about 34; ventrals as long as head. borealis, 892.
    - *d.* Palatine teeth well separated; lower half of subopercle with coarse, radiating striæ; only 2 or 3 ridges parallel with the posterior edge of the bone present.
    - *dd.* Palatine teeth close-set; lower half of subopercle for the most part with striæ parallel with the posterior edge of the bone. serra, 893.

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* The name *Plagyodus* has been lately accepted by Dr. Günther for this genus. A specimen of one of the Pacific species was obtained by Steller from the Kurile Islands, and a brief description of it, under the name of *Plagyodus*, left by him in manuscript, was afterwards quoted by Pallas, as a species unknown to him. Steller wrote before Linnæus, and apparently used the name *Plagyodus* as a mononomial designation for his particular specimen or species, rather than in the sense of a Linnæan genus. It seems to us, at present, best to retain the name *Alepisaurus*.

### Subgenus ALEPISAURUS.

### 889. ALEPISAURUS FEROX, Lowe.

(LANCET FISH.)

Eye 6 in head. D. 41 to 44; A. 14 to 17; P. 14 or 15; V. 9 or 10. Length of head twice height of body, and rather less than ⅙ of the total. Eye median, as wide as the interorbital space. Dorsal fin much elevated; pectorals elongated, but not reaching nearly to ventrals; first ray of dorsal, pectoral, and ventral serrated; upper caudal lobe produced into a long filament. (Günther.) Deep waters of the Atlantic; occasionally obtained off the coasts of Nova Scotia and Massachusetts, and the Grand Banks. (*ferox*, ferocious.)

*Alepisaurus ferox*, LOWE, Trans. Zoöl. Soc. Lond., I, 1833, 395, Madeira; GÜNTHER, Cat., v, 421, 1864; JORDAN & GILBERT, Synopsis, 276, 1883.

*Alepisaurus azureus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XXII, 530, 1849, Canaries.

### 890. ALEPISAURUS ÆSCULAPIUS* (Bean).

(SUBATKA; WOLF-FISH.)

Head 6; depth 10½; eye 5. D. 39; A. 16; P. 13; V. 8; B. 7. Vertebræ 50. Body stouter posteriorly than in *A. ferox*; snout twice as long as eye; premaxillary 1⅓ in head, extending behind the eye a distance equal to ⅓ eye. Median line with a well-marked fleshy keel from before ventrals to caudal. Longest dorsal ray 6 in body, ⅒ longer than head, its anterior edge finely serrated (dorsal rays not perfect in type specimen). Insertion of dorsal over gill opening and base of pectoral; pectoral about ⅕ shorter than head; ventral 2¾ in head, its first ray smooth. Dark gray, sides silvery and iridescent, a row of small translucent spots on each side of lateral line and keel; dorsal black, with steel-blue reflections; adipose fin, pectorals, and caudal black; ventrals and anal silver-gray. Coast of Alaska, and southward to California, in deep water, occasionally running on shore. (Bean.) The type specimen, speared at Unalaska, by Robert King, had in its stomach 21 individuals of *Eumicrotremus spinosus*. It was probably driven ashore by the tortures of a parasite (*Tetrarhynchus*) found in its flesh. Length over 3 feet. Another specimen was taken at Unalaska by Dr. W. H. Dall; another[*] was obtained off Eureka, California (Humboldt Bay), by A. J. Wiley and J. B. Brown; and still another came ashore on the coast of San Luis Obispo County, California, in October, 1894. Steller's specimen,[†] "Piscem hunc mirabilis structuræ et formæ," seems to be this species rather than *Alepisaurus borealis*. (*Æsculapius*, the father of medicine, from the lancet-like teeth.)

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* A fine specimen of this species, four feet in length, came ashore on the coast of San Luis Obispo County, California, in October, 1894, and was sent to the Museum of the California Academy of Sciences by Mr. W. P. Stevens.

Dorsal rays 38; ventral rays 9. Vertebræ about 35 + 20 = 55, the number not exactly counted. Longest dorsal ray 1⅙ in head; pectoral fins about 2; ventral fins 2⅔ in head. Opercle as in the Eureka specimen, with strongly marked radiating ridges. Subopercle with similar ridges, the uppermost and strongest running to the upper posterior corner of the bone, the few above it short and soon running out in the upper edge of the bone. Lower jaw strongly striated. Shoulder girdle rugose. Gill rakers short, few, and small; strongly toothed. Pseudobranchiæ well developed. Eye 2⅓ in snout. Upper jaw with a series of very small teeth along its entire edge. Vomer with three enormous, dagger-like canines, arranged in a triangle, the median one in advance; three canines on palatines on each side, turned a little backward; 8 small compressed retrorse teeth behind them. Lower jaw with two large canines in front on each side; nine small ones behind these; then 5 large compressed canines, smaller than those in front, which in turn are smaller than those on palatines, which are smaller than those on vomer. Behind these 5 canines are 15 smaller teeth, compressed, retrorse, like the teeth of a saw. Color blackish, silvery below and on fin rays of lower fins. Dorsal mottled with darker. A description and figure of this specimen has recently been published by Miss Flora Hartley. (Proc. Cal. Ac. Sci., 1895.)

*Plagyodus*, Steller, in Pallas, Zoog. Rosso-Asiat., III, 383, 1811, Kurile Islands.

*Alepidosaurus æsculapius*, Bean, Proc. U. S. Nat. Mus., 1882, 661, Iliuliuk, Unalaska. (Type, No. 27705. Coll. Robert King); Flora Hartley, Proc. Cal. Ac. Sci., 1895.

### Subgenus CAULOPUS, Gill.

### 891. ALEPISAURUS ALTIVELIS, Poey.

(Conejo.)

Head 6¼ in total length; depth 13½; eye 5¼. D. 40; A. 17; P. 16; V. 13; C. 30; B. 7. Maxillary extending beyond eye. Dorsal very high, its height 3 times depth of body; pectorals falcate, their length twice depth of body; ventrals reaching vent, their length less than depth of body; caudal forked, with equal lobes. Lateral line distinct. Color silvery, with blue shades. Length 3 feet. Cuba; in deep water. (Poey.) (*altus*, high; *velum*, sail.)

*Alepisaurus altivelis*, Poey, Memorias, II, 302, 1861, Cuba; Günther, Cat., v, 423, 1864.

*Alepidosaurus* (*Caulopus*) *poeyi*,[‡] Gill, Proc. Ac. Nat. Sci. Phila., 1862, 131, Cuba; (based on a specimen slightly different in proportions, the upper lobe of the caudal longest).

### 892. ALEPISAURUS BOREALIS (Gill).

(Hand-saw Fish.)

Depth of head 4½ times its length; eye 5½; snout 2½. D. 34; V. 13; B. 5. Nostrils nearer eye than tip of snout; opercle with 18 prominent ridges; subopercle divided into two parts by a horizontal ridge, the upper part irregularly triangular, with about 9 striæ; the lower part with coarse striæ, the upper ones interrupted behind by 2 or 3 ridges parallel with the posterior border; lower jaw robust, its length 1⅓ in head, its upper edge slightly convex. Teeth on the upper jaw very small, acute, and numerous; vomerine fangs very large, nearly equal, slender, and slightly curved, the longest 6⅔ in head; large palatine teeth similar, about 10 in head; small trenchant teeth behind them, large teeth of lower jaw 12 in head, slender, moderately curved. First dorsal ray rather stout and with a prominent compressed ridge anteriorly, which is crenulate in front; ventral fins at least as long as head, the first ray undivided, crenulate.

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[*] This specimen differs somewhat from Bean's type, as the following description shows: "Head 5⅓; depth 9. D. 36; A. 16; V. 10. Eye 2⅓ in snout, 5½ in head; pectoral long, falcate, and pointed, 1⅙ in head; ventrals about 2¾ in head; space between pectorals and ventrals 3½ in body; insertion of ventrals slightly nearer base of caudal than tip of snout; dorsal fin very high, depressible in a groove, the longest rays (2d to 15th) 4⅓ in length of body and about ⅓ longer than head; anal low, but slightly falcate in front, the free edge concave; caudal deeply forked, the lobes pointed and equal. Color dark iridescent, a round pale spot on body at base of each ray of anterior half of dorsal. Description from photographs taken by Mr. Augustus J. Wiley of Eureka, from a large specimen which ran ashore near Humboldt Bay in 1892. The specimen was not preserved, but at the time the photographs were taken it was in better condition than any other specimen yet seen in the Pacific. It would seem to differ from *A. æsculapius* in the much higher dorsal, and perhaps in the more slender tail.

[†] This was a dried specimen 44 inches long; pectoral 6 inches; ventral 2½ inches; description chiefly of the teeth.

[‡] Head 7 in length instead of 6½, as in *altivelis*; the depth 15. From base of pectoral to base of anal the same distance as to the anal, less ¼ (instead of less ⅙); first dorsal ray ⅓ the next (½ in *altivelis*); fourth longer; sixth to twenty-fourth all high and equal (2 to 22 high and equal in *altivelis*). D. 41. Upper lobe of caudal prolonged, the lobes separate. Ventral reaching past vent, its length greater than depth of body. Color of dorsal uniform.—*Poey*.

Alaska to Puget Sound, occasionally cast on shore by storms; only mutilated specimens yet seen. The head in the type 7½ inches long. The type from Puget Sound; another taken by Prof. George Davidson at Captain's Harbor, Unalaska; a head from Puget Sound, and another from the Aleutian Islands, preserved in collections in San Francisco, are the only specimens known. (*borealis*, northern.)

*Alepidosaurus* (*Caulopus*) *borealis*, Gill, Proc. Ac. Nat. Sci. Phila., 1862, 128, Puget Sound; Günther, Cat., v, 423, 1864; Jordan & Gilbert, Synopsis, 278, 1883.

### 893. ALEPISAURUS SERRA (Gill).

(Serra.)

Head 6 in total length, flattish above, its height ⅖ its length; eye 5½ in head; snout 2½ in head; V. 13; subopercle divided into two parts by a ridge, the upper nearly equally triangular, its base lunately emarginate, with 10 to 14 radiating striæ; the lower portion with its upper surface wrinkled parallel with the oblique posterior margin, its lower half with slight radiating striæ; lower jaw 1⅓ in head, its upper outline nearly straight; longest vomerine teeth 8 in head; smaller palatine teeth closer together than in *A. borealis*; fins destroyed, except base of ventral. This "species differs from *Caulopus borealis* by the oblong operculum, and the nearly equal triangular shape of the coalescent infraopercular bone (subopercle and interopercle) above the dividing ridge, but with an oblique excavation at its base, which describes nearly the third of a circle, as well as the sculpture of the portion below the dividing ridge. The vomerine teeth are stronger, but less elongated, and the palatine approximated and not curved. (Gill.) Known from one specimen discovered at Monterey, California, by Mr. A. S. Taylor, in 1859. It weighed 7 pounds; its length 4 feet; the sun-dried fragments constituting the type of the description. (*serra*, saw, the Spanish name, 'which has the advantage of at the same time perpetuating the popular name, and of being classical, and of describing one of the peculiarities of the palatine dentition which distinguishes it from the *A.* (*C.*) *borealis*.'" (Gill.)

*Alepidosaurus* (*Caulopus*) *serra*, Gill, Proc. Ac. Nat. Sci. Phila., 1862, 129, "Monterey, Lower California." (Coll. A. S. Taylor.)

## Family LXXXII. ODONTOSTOMIDÆ.

Body oblong, compressed, naked; mouth very wide, its margin formed by premaxillaries only; premaxillaries with curved teeth; large, curved, lanceolate, depressible teeth on mandible, vomer, and palatines. Eye very large, the orbital cavity expanded downward. Dorsal short, median or posterior; adipose fin small. Pseudobranchiæ well developed. No air bladder. Deep-sea fishes; two genera and two species known.

a. Post-temporal of peculiar form, partly naked; stomach very distensible. OMOSUDIS, 285.

## 285. OMOSUDIS, Günther.

*Omosudis*, GÜNTHER, Challenger Report, XXII, 201, 1887, (*lowii*).

Body oblong, compressed; head compressed, naked; snout of moderate length; cleft of mouth very wide; premaxillary and maxillary bones slender, the former with a series of very small teeth of equal size, only one or two anterior ones being somewhat enlarged; the lower jaw, the vomer, and palatine bones with a few very large and lanceolate teeth. Lower jaw broad, and, like the rest of the head, formed of very thin bone. The supraclavicle and postclavicles form a long rod extending from occiput on each side downward to the abdomen, and partly free, not covered by skin. Ventral fins inserted far behind the pectorals, below the origin of the dorsal; dorsal fin behind the middle of the length of the body; adipose fin very small; anal fin long. Stomach very distensible. Branchiostegals 8; pseudobranchiæ well developed; gills 4, with broad gill laminæ and very short gill rakers. (ὦμος, shoulder; *Sudis*.)

### 894. OMOSUDIS LOWII, Günther.

Head 3½; depth 5; eye 3. Head strongly compressed, with rather flat upper surface; snout somewhat pointed, rather longer than eye. Bones of head extremely thin, the opercle being smaller than the subopercle, and separated by two or three ridges. Infraorbital ring nearly membranaceous. Preoperculum terminating below in a forked point. Cleft of mouth extending backward to angle of preoperculum. Dentition truly formidable for so small a fish; the longest tooth is one anteriorly on the side of the mandible; in the British Museum specimens, only one is present either on the right or left of the jaw; its length nearly ⅕ of that of the head; the next largest are those on the palate, where there are two on each side, besides several smaller ones; smaller teeth are also implanted on the hinder part of the dentary bone; all the large teeth can be laid backward. A semicircular, scale-like, osseous lamella of extreme thinness covers lower part of cheek, it is marked by very shallow, concentric striæ. The singular bone which supports the side of the anterior part of the abdomen is styliform, slightly curved backward; it starts from the top of the occiput and descend toward the median line of the abdomen, which it reaches behind the pectoral fin; it is composed of the two-pronged supraclavicle, which is fixed by ligaments to the occiput, and of three slender, needle-shaped postclavicles; the uppermost postclavicle is suspended by ligaments from the supraclavicle, as is also the clavicle; the rod lies immediately below the thin integument, and its lower portion is quite free. Dorsal fin inserted midway between root of caudal and eye, and composed of very feeble rays; the anal commences at some distance behind the dorsal and terminates not very far from the caudal; caudal fin small, with a considerable number of basal rays above and below; pectoral fins quite at the lower side of the body; ventral fins very small and partly coalescent. Light brownish on the back, with numerous brown pigment spots on the sides; abdomen black. (Günther.)

Günther described this genus and species from a specimen 3½ inches long, obtained south of the Phillipine Islands, in 500 fathoms. He had previously obtained, in 1868, the specimen collected by Lowe at Magdalena. The *Albatross* obtained a single specimen from station 2392, at a depth of 724 fathoms. The capacity of this form for swallowing fishes greater in size than itself appears to be as great as that of *Chiasmodus*. (Goode & Bean.) (Named for its discoverer, Rev. R. T. Lowe, the historian of the fishes of Madeira.)

*Omosudis lowii*, GÜNTHER, Challenger Report, XXII, 201, pl. 52, figs. *c*, *c'*, 1887, Philippine Islands; Magdalena; GOODE & BEAN, Oceanic Ichthyology, 122, fig. 150, 1895.

## Family LXXXIII. PARALEPIDIDÆ.

Body elongate, somewhat compressed, formed much as in a Barracuda, covered with cycloid scales of moderate or rather large size. Head long, usually scaly on the sides. Mouth very large, lower jaw projecting. Premaxillary not protractile, very long and slender, forming the entire margin of upper jaw; maxillary long and slender, closely adherent to premaxillary. Teeth rather strong, pointed, in single series on the jaws and palatines; some of them on lower jaw and palatines sometimes very long and fang-like, and most of them freely depressible. Opercular bones thin. Pseudobranchiæ present. Gill membranes separate, free from the isthmus. Branchiostegals about 7. Gill rakers short, sharp, spine-like. Eye large. Lateral line present, its scales usually enlarged. Dorsal fin short and small, behind the middle of the body, nearly or quite over the ventrals; adipose fin present; anal fin low, rather long; caudal fin short, narrow, forked; pectorals rather small, placed low. Pyloric cœca none. No air bladder. Phosphorescent spots few or none. Genera 3 or 4, species about 12; voracious fishes of the open seas or the deep seas.

PARALEPINÆ:

*aa.* Body scaly; stomach not remarkably distensible; luminous spots usually present, but inconspicuous.
  *b.* Lower jaw with 3 to 5 very long fang-like teeth on each side; snout moderately pointed. SUDIS, 286.
  *bb.* Lower jaw without distinct fang-like teeth.
    *c.* Ventrals inserted entirely behind dorsal, their distance from eye twice the distance from base of caudal; snout attenuate. ARCTOZENUS, 287.
    *cc.* Ventrals inserted below front of dorsal. PARALEPIS, 288.

## 286. SUDIS, Rafinesque.

*Sudis*, RAFINESQUE, Caratteri di Alcuni Nuovi Generi, etc., 60, 1810, (*hyalina*).

Body elongate, somewhat compressed, with cycloid scales of moderate size. Head long, scaly on the sides. Mouth very large, the lower jaw projecting, the cleft turned upward toward its end. Premaxillary very long and slender, forming the entire upper margin of the upper jaw; maxillary long and slender, closely adherent to the premaxillary. Teeth rather strong, pointed, in single series on the jaws and palatines, 3 to 5 of them on lower jaw very long and fang-like or dagger-shaped; most of them freely depressible. Opercular bones thin. Pseudobranchiæ present. Gill membranes separate, free from the isthmus. Branchiostegals about 7. Gill rakers short, sharp, spine-like. Eye large. Lateral line present, its scales usually enlarged. Dorsal fin short and small, behind the middle of the body, nearly or quite over the ventrals; adipose fin present; anal fin low, rather long; caudal fin short, narrow, forked; pectorals rather small, placed low. Pyloric cœca none. No air bladder. Luminous spots little developed. Deep waters of the Atlantic and Pacific; resembling *Sphyræna* in form and dentition. Species few. This genus is allied to *Alepisaurus*, which, in the structure of the mouth, it much resembles, although differing in the development of its fins. (*Sudis*, a stake, an ancient name of the Barracuda.)

*a.* Maxillary not reaching eye; dorsal rays 7 or 8. INTERMEDIUS, 895.
*aa.* Maxillary reaching eye; dorsal rays 11. RINGENS, 896.

### 895. SUDIS INTERMEDIUS (Poey).

Head 5½ in total length; depth 7; eye 6⅔ in head, 3½ in snout. D. 7 or 8; A. very long, its rays not counted; V. 10; P. 15; B. 8. Body compressed. Bones of snout transparent; mouth large, its cleft not reaching eye; jaws equal; maxillary parallel with premaxillary; premaxillary with 2 canines in front, its border with many small recurved teeth; lower jaw with 2 similar canines and a dozen large lateral teeth; those of the middle largest, curved like half a lance head, these alternating with small teeth; no vomerine teeth; palatine teeth large, curved, uniserial; tongue with teeth along its side; no scales present when first seen; lateral line narrow, marked by elevations of the skin. Ventrals small, in middle of length, before the dorsal; insertion of anal midway between ventral and caudal; dorsal inserted midway between ventrals and anal; caudal short, concave; no evident adipose fin. Flesh color, the sides silvery. One specimen known, from Matanzas, Cuba. (Poey.)

*Paralepis intermedius*, POEY, Repertorio, II, 416, 1867, Matanzas.

### 896. SUDIS RINGENS, Jordan & Gilbert.

Head 4; depth 16. D. 11; A. 25. Body very slender and elongate, compressed. Head rather slender, anteriorly pointed and moderately depressed. Mouth large, horizontal, the gape extending more than half length of head. Margin of the upper jaw formed entirely by the very slender, nearly straight premaxillaries, which are closely appressed to the long and slender maxillaries; maxillaries extending to below the eye, nearly as far as the mandibular joint; tip of upper jaw emarginate; tip of lower jaw rather broad, turned up and fitting in the notch of the upper jaw; premaxillaries armed with a series of small, sharp, subequal, close-set teeth, which are hooked backward; a long, slender canine in front on each side; lower jaw with about 10 sharp, slender teeth on each side, these teeth very unequal, some of them short, 3 or 4 very long and canine-like; near the front a fang-like tooth on each side, then a considerable interspace, behind which the others are arranged partly in 2 rows; most of these teeth, especially the inner and larger ones and the anterior canines, are freely depressible; a long series of teeth on the palatines, 1 or 2 of the anterior teeth on each side and 1 or 2 others long, slender, and fang-like. Tongue free anteriorly, roughish, but apparently without teeth. Scales very large, cycloid. Dorsal fin inserted somewhat behind the middle of the body, at a distance of nearly 4 times its base in front of the anal, its height a little greater than the length of its base; anal fin anteriorly nearly as high as the dorsal, its posterior rays low; pectoral fins placed low, rather short, about as long as the maxillary; caudal fin short, narrow, apparently forked; ventrals (lost in the type) probably in front of the dorsal. Coloration light olive, the sides silvery, with dark punctulations. Peritoneum silvery, underlaid by black pigment. Santa Barbara Channel, California, the only specimen known taken from the stomach of a hake (*Merluccius*), itself found in the stomach of a long-finned albicore (*Germo alalunga*). (*ringens*, gaping.)

*Sudis ringens*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1880, 273, Santa Barbara Channel. (Type, No. 27401. Coll. Jordan & Gilbert); JORDAN & GILBERT, Synopsis, 277, 1883.

## 287. ARCTOZENUS, Gill.

*Arctozenus*, GILL, Proc. Ac. Nat. Sci. Phila., 1864, 188, (*borealis*).

Head elongate, conical, the snout attenuate, the jaws straight, the lower mostly covered by the upper; teeth of lower jaw anteriorly slender, recurved, and distant; posteriorly small, acute, and close together. This genus is closely related to *Sudis*, from which it differs mainly in the absence of fang-like teeth. From *Paralepis* it differs in the position of the ventral fins, which are entirely behind the dorsal. The known species belong to the deep waters of Arctic America; long, slender fishes suggesting the Barracuda in outline. (ἄρκτος, northern; ξένος, strange.)

| | |
|---|---|
| *a.* Teeth comparatively strong; Atlantic species. | BOREALIS, 897. |
| *aa.* Teeth comparatively weak; Pacific species. | CORUSCANS, 898. |

### 897. ARCTOZENUS BOREALIS (Reinhardt).

Head 4½; depth 12. B. 7; D. 8; A. 32; P. 11; V. 9. Snout as long as rest of head; mandible included, its upturned tip fitting into an emargination of upper jaw. Teeth as in *A. coruscans*, but considerably stronger. Pectoral and ventral fins small, the latter inserted behind the dorsal. Color plain. Greenland; occasionally southward to Cape Ann; scarce. (*borealis*, northern.)

*Paralepis borealis*, REINHARDT, Naturv. Math. Afhandl., VII, 115, 1832, Greenland; GÜNTHER, Cat., V, 419, 1864.

*Arctozenus borealis*, GILL, Proc. Ac. Nat. Sci. Phila., 1864, 188.

*Sudis borealis*, JORDAN & GILBERT, Synopsis, 278, 1883.

### 898. ARCTOZENUS CORUSCANS (Jordan & Gilbert).

Head 4; depth 13. D. 8; A. 31; P. 11; V. 9; scales 60. Body very elongate, of nearly uniform depth, the caudal peduncle very slender; abdomen compressed. Head long; snout sharp, half length of head. Eye large, high. Jaws equal; maxillary reaching vertical from nostril; tip of lower jaw fitting into an emargination of premaxillaries; none of the teeth fang-like; premaxillaries laterally with minute teeth; 4 or 5 longer teeth in front; vomer with minute teeth; anterior palatine teeth long, the posterior short; teeth of lower jaw slender, distant, unequal. Scales deciduous, those of lateral line enlarged. Fins all very small; ventrals entirely behind dorsal, their distance from front of orbit twice that from base of caudal; distance from front of dorsal to base of caudal half its distance from tip of snout; caudal widely forked. Dusky olivaceous; sides of head silvery; bases of fins generally black; rami of mandible each with a double series of minute phosphorescent spots. Puget Sound; one specimen known, scarcely differing from the preceding, the teeth a little weaker. (*coruscans*, sparkling.)

*Paralepis coruscans*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1880, 411, Port Townsend. (Type, No. 27171. Coll. Brown.)
*Sudis coruscans*, JORDAN & GILBERT, Synopsis, 278, 1883.

## 288. PARALEPIS, Risso.

*Paralepis*, RISSO, Hist. Nat. Eur. Mérid., III, 472, 1826, (*coregonoides*).

Head and body elongate, compressed, covered with deciduous scales, those of the lateral line being the largest. Cleft of the mouth very wide; maxillary developed, closely adherent to the intermaxillary. Teeth unequal in size, some in the mandible and on the palatine bones being rather larger than the others; they are arranged in single series, in the intermaxillary and mandible, on the palatine and pterygoid bones. Eye large. Pectoral fins well developed; ventrals small, inserted at a great distance from the pectorals, below or immediately behind or in front of the dorsal fin; dorsal fin short, on the hind part of the body; adipose fin small; anal elongate, occupying the end of the tail; caudal emarginate. Gill opening very wide, the outer branchial arch beset with short, spine-like gill rakers; pseudobranchiæ well developed; branchiostegals 7. Air bladder none. Pyloric appendages none. (παρά, near; λεπίς, scale; scales on side.)

### 899. PARALEPIS COREGONOIDES, Risso.

Head 4; depth 12; eye 5. D. 10; A. 23; P. 13; V. 9. Body elongate. Head compressed. Snout long, conical; cleft of mouth moderate; maxillary rod-like, adherent to premaxillary. Teeth in a single row in the intermaxillary, a few enlarged anteriorly; also on palatines and pterygoids. Ventral fin very short, inserted below the anterior part of the dorsal. Gill openings very large, free from the isthmus; gill rakers very numerous, minute. Color silvery; slightly bluish upon the back; blackish upon the belly on account of the transparency of the black peritoneum; along the lateral line there are some blackish dots; iris silvery; the pupil blackish, silvery. Rare in the Mediterranean. The *Albatross* obtained a specimen (No. 37860, U. S. N. M.) from station 2393, at a depth of 525 fathoms. (*Coregonus*, the whitefish; εἶδος, likeness.) (Eu.)

*Paralepis coregonoides*, RISSO, Hist. Nat. Europe Méridionale, III, 472, pl. VII, fig. 15, 1826, Nice; GÜNTHER, Cat., 419, 1864; GOODE & BEAN, Oceanic Ichthyology, 119, 1895.

## Family LXXXIV. STERNOPTYCHIDÆ.

Fishes "with compressed ventradiform body, carinated contour, deeply and obliquely cleft and subvertical mouths, whose upper margin is constituted by the supramaxillaries as well as the intermaxillaries; branchiostegal arch near and parallel with lower jaw, scapular with an inferior projection, and with one or more of the neural spines abnormally developed, and projecting above the back in advance of the dorsal fin." (Gill.) Genera 2, species about 10; deep-sea fishes, rising toward the surface at night or in stormy weather. (*Sternoptychidæ*, Günther, Cat., v, 384, 1864, part group *Sternoptychina.*)

*a.* Projecting neural spine before dorsal single; spine-like abdominal outline nearly continuous in a sigmoid curve; branchiostegals 5. STERNOPTYX, 289.

*aa.* Projecting neural spines, several constituting a saw-like ridge before dorsal; abdominal outline abruptly contracted before anal; branchiostegals 9. ARGYROPELECUS, 290.

### 289. STERNOPTYX, Hermann.

*Sternoptyx*, HERMANN, Naturforscher, XVI, 8, 1771, (*diaphana*).

Trunk much elevated and compressed, the slender tail very short; abdominal outline nearly continuous, in a sigmoid curve; teeth of the jaws in several series, the largest teeth in the inner row; a single spike-like neural spine before dorsal; branchiostegals 5. Otherwise essentially as in *Argyropelecus*. (*στέρνον*, breast; *πτύξ*, fold or plait.)

#### 900. STERNOPTYX DIAPHANA, Hermann.

B. 5; D. 9; A. 13; P. 10; V. 3. Depth equal to distance between tip of snout and base of the very short tail. Interorbital space slightly concave; posterior limb of preopercle bordering hind part of orbit, and descending very obliquely, ending in two points. Pectoral scarcely reaching ventrals, which are very small. (Günther.) Atlantic; occasionally taken in the Gulf Stream, from Santa Cruz Island to the Grand Banks. (*diaphanus*, *διαφανής*, transparent.)

*Sternoptyx diaphana*, HERMANN, Naturforscher, XVI, 8, 1771, Jamaica; GÜNTHER, Cat., v, 387, 1864; GOODE & BEAN, Bull. Mus. Comp. Zoöl., x, No. 5, 1883, 220.

*Sternoptyx hermanni*, LACÉPÈDE, Hist. Nat. Poiss., v, 613, 1803; after HERMANN.

### 290. ARGYROPELECUS, Cocco.

*Argyropelecus*, COCCO, Giorn. Sci. Sicil., fasc. 77, 146, 1829, (*hemigymnus*).

*Pleurothyris*, LOWE, Fishes of Madeira, 64, 1861, (*olfersi*).

Body much elevated and compressed, passing abruptly into the short tail; no scales, the skin covered with silvery pigment; series of luminous spots along the lower side of the head, body, and tail. Head large, compressed, and elevated, the bones thin, but ossified. Cleft of mouth wide, vertical, the lower jaw prominent. Margin of upper jaw formed by the maxillary and premaxillary, both of which have a sharp edge which is beset with minute teeth; lower jaw and palatine bones with a series of small curved teeth. Eyes large, very close together, lateral, but directed upward. Angle of preopercle with a spine usually directed downward.

Pectorals well developed; ventrals very small. Humeral arch and pubic bones prolonged into flat pointed processes, which project in the median line of the belly; a series of imbricated scales from the humeral bone to the pubic spine, forming a ventral serrature. Dorsal fin short, median, preceded by a serrated, osseous ridge, consisting of several neural spines prolonged beyond the muscles; adipose fin rudimentary; anal fin short; caudal forked. Gill opening very wide, the outer branchial arch extending forward to behind the symphysis of the lower jaw, and beset with very long gill rakers; branchiostegals 9, the arch near lower jaw and parallel with it; pseudobranchiæ and air bladder present. Four pyloric cœca. Small pelagic fishes found in most seas, coming to the surface at night, descending into deep water by day. (*ἄργυρος*, silvery; *πέλεκυς*, hatchet.)

*a.* Anal rays 11; no spines along lower sides of caudal peduncle.
  *b.* Pectoral fin nearly reaching anal. HEMIGYMNUS, 901.
  *bb.* Pectoral fin reaching ventrals. OLFERSI, 902.

### 901. ARGYROPELECUS HEMIGYMNUS, Cocco.

B. 9; D. 7 or 8; A. 11; P. 9; V. 5. Depth of body equal to distance between gill openings and base of caudal; posterior corner of mandible and angle of preopercle each with a small triangular spine; tail without spines; pectoral fin nearly reaching anal. Length 2 inches. (Günther.) Atlantic and Mediterranean in deep water; occasional in the Gulf Stream, off southern New England. (*ἡμι-*, half; *-γυμνός*, naked.) (Eu.)

*Argyropelecus hemigymnus*, Cocco, Giorn. Sci. Sicil., fasc. 77, 146, 1829, **Coast of Italy**; Cuvier & Valenciennes, Hist. Nat. Poiss., XXII, 398, 1849; Günther, Cat., v, 385, 1864; Goode & Bean, Bull. Mus. Comp. Zoöl., x, No. 5, 1883, 220.

*Sternoptyx mediterraneus*, Cocco, Giorn. Faro de Messina, IV, 7, 1838, **Coast of Italy**.

### 902. ARGYROPELECUS OLFERSI (Cuvier).

B. 9; D. 9; A. 11; P. 10; V. 6. Depth nearly or quite equal to distance from shoulder to root of caudal; tail as deep at base as long. Mandible with a short, flat spine at its posterior corner; preopercle spine directed downward; tail without spines; pectoral fin reaching ventrals. (Günther.) Open Atlantic; coast of Norway to Brazil and Cape of Good Hope, occasionally taken in the Gulf Stream from the Grand Banks southward. (Named for J. F. M. von Ölfers, who sent specimens from Brazil to the Museum of Paris.) (Eu.)

*Sternoptyx olfersi*, Cuvier, Règne Animal, Ed. 2, II, 316, 1829, **near Cape of Good Hope**.

*Argyropelecus durvillii*, Cuvier & Valenciennes, Hist. Nat. Poiss., XXII, 405, 1849, **open Atlantic**.

*Argyropelecus olfersi*, Cuvier & Valenciennes, Hist. Nat. Poiss., XXII, 408, 1849; Günther, Cat., v, 386, 1864; Lilljeborg, Sveriges Fiskar, VI, 3, 1889.

*Pleurothyris olfersi*, Lowe, Fishes Madeira, 64, 1861.

## Family LXXXV. IDIACANTHIDÆ.

Fishes eel-like in form "with spiny processes from anterior portion of vertebræ projecting through the skin of the body. Pectorals absent. Body naked. Dorsal fin beginning in advance of the vent." (Gill.) One genus with 3 species known; deep-sea fishes, eel-like in appearance.

## 291. IDIACANTHUS, Peters.

*Idiacanthus*, PETERS, Monatsber. Akad. Wiss. Berlin, 1876, 846, (*fasciola*).
*Bathyophis*, GÜNTHER, Ann. Mag. Nat. Hist., 1878, 181, (*ferox*).

Body snake-like, very slender and elongate, scaleless. Vent very far back. Head large, compressed, the snout moderate, the cleft as long as head. Teeth extremely large, numerous, unequal, fang-like, depressible, present on jaws, vomer, and palatines. Eye small; opercles narrow. Hyoid bone with a long barbel. Dorsal long and very low, extending from above ventrals nearly to caudal; the rays simple, each one placed behind a pair of spine-like processes; no adipose fin; no pectorals; ventrals median. A luminous organ above middle of upper jaw and a series of luminous dots along side of belly and on outer ray of ventral and on tail. Gill openings very wide; branchiostegals short, numerous. Gills 4; no pseudobranchiæ. Vertebræ numerous, 67 in *Idiacanthus ferox.* Three species known. (ἴδιος, peculiar; ἄκανθα, spine.)

*a.* Dorsal fin inserted opposite root of ventrals; anal rays 45. FEROX, 903.
*aa.* Dorsal fin inserted well in advance of ventrals; anal rays about 35. ANTROSTOMUS, 904.

### 903. IDIACANTHUS FEROX (Günther).

D. 60; A. 45; V. 6. Vertebræ 67. Vent in sixth eighth of total length. Dorsal inserted opposite ventrals. Color black. North Atlantic, nearly midway, in 2,750 fathoms. One specimen, 8 inches long. (Günther.) (*ferox*, fierce.)

*Bathyophis ferox*, GÜNTHER, Ann. Mag. Nat. Hist., II, 1878, 181, North Atlantic.
*Idiacanthus ferox*, GÜNTHER, Deep-Sea Fishes Challenger, XXII, 216, 1887.

### 904. IDIACANTHUS ANTROSTOMUS, Gilbert.

Head 12; depth 16. D. 57; A. about 35. Abdomen much dilated, abruptly constricted immediately behind the ventral fins, and much narrowed anteriorly, the depth again increasing to occiput. Greatest depth immediately in front of ventrals. Maxillary reaching edge of gill cover. Teeth in a single series in each jaw, readily depressible, varying greatly in length; teeth in the upper jaw arranged in groups of 4 or 5, the anterior member of each group being very short, the others rapidly increasing backward, the posterior tooth very long; lateral teeth in mandible inserted at the extreme outer edge of the jaw, the anterior teeth inserted farther inward; thus the last of the anterior teeth are distinctly within the first of those on sides of jaw; a single small tooth on each side of vomer, and 2 or 3 posteriorly on palatines; 3 pairs of teeth directed backward from near tip of tongue. Eye over first third of length of maxillary; lower jaw much longer than the upper. Barbel $\frac{1}{5}$ longer than the head, expanded near its tip, and again narrowed as in *I. ferox.* Dorsal beginning well in advance of ventrals, its distance from tip of snout $3\frac{1}{3}$ in total length; anterior rays distant, the membrane from one ray reaching only to basal portion of the succeeding ray; each ray starting behind a pair of short spinous projections which diverge backward, the fin when depressed lying in the groove formed by these diverging pairs of spines; caudal forked, the rudimentary rays extending well forward on caudal peduncle, nearly meeting posterior rays of dorsal and anal; vent immediately in front of anal fin, far behind the dilated abdomen, its distance from end of caudal 3$\frac{1}{5}$ in total length; anal similar to dorsal; ventrals about $\frac{3}{4}$ length of maxillary, very slender, apparently of 5 or 6 slender rays, inserted much nearer front of anal than head, their distance from anal about half their distance from tip of snout. Black, the mandible lighter, the base and terminal portion of barbel and the caudal translucent. No evident phosphorescent spot on cheek; 4 series of minute phosphorescent dots on abdomen, the lateral series extending but a short distance behind ventrals, the median series uniting to form a single row behind these fins. Length 4½ inches. Off the coast of Southern California in 603 fathoms. (*ἄντρον*, cavern; *στόμα*, mouth.)

*Idiacanthus antrostomus*, GILBERT, Proc. U. S. Nat. Mus., 1890, 54, Albatross Station 2980, in 603 fathoms, off southern California. (Type, No. 44286. Coll. Gilbert.)

## Order U. LYOPOMI.

This group, which contains the single family of *Halosauridæ*, is thus defined by Gill:

Scapular arch constituted by proscapula, posterotemporal and post-temporal, the post-temporal discrete from side of cranium and impinging on supraoccipital; hypercoracoid and hypercoracoid lamellar; a foramen in upper margin of hypocoracoid; mesocoracoid absent; actinosts normal; cranium with the condyle confined to basioccipital. Opercular apparatus characteristic, the preopercle entirely detached from the suspensorium (rudimentary and connected only with the lower jaw); operculum normally connected, subopercle enlarged and partly usurping the usual position of the preopercle, in company with the suborbital chain which is extended backward to the opercular margin; bones of jaws, palatines, and pterygoid complete and normal; anterior vertebræ separate; ventrals abnormal. (*Lyopomi*, Gill, American Naturalist, November, 1889, 1016.) (*λύω*, loose; *πῶμα*, operculum.)

### Family LXXXVI. HALOSAURIDÆ.

Body elongate, compressed anteriorly, tapering into a very long and slender tail, which becomes compressed and narrowed into a sort of filament. Abdomen rounded. Scales rather small, cycloid, deciduous; sides of head scaly; lateral line present, running along the sides of the belly, its scales in the known species enlarged, each in a pouch of black skin with a luminous organ at its base. No barbels. Head subconical, depressed anteriorly, the flattened snout projecting beyond the mouth. Mouth inferior, horizontal, of moderate size, its anterior margin formed by the premaxillaries, its lateral margin by the maxillaries, which are of moderate width. Teeth small, in villiform bands, on the jaws, the rudimentary palatines and pterygoids; none on vomer and tongue. Eye rather large. Facial bones with large, muciferous cavities. Opercular apparatus peculiar, the preopercle entirely detached from suspensorium, rudimentary, and connected only with lower jaw; opercle normally connected;

subopercle enlarged and partly usurping the usual position of the preopercle, in company with the suborbital chain, which is extended backward to the opercular margin. Bones of head unarmed. Gills 4, a slit behind the fourth. Pseudobranchiæ none; gill rakers short; gill membranes separate from the isthmus. Branchiostegals numerous (about 14). Dorsal fin short, rather high, inserted behind ventrals and before vent; no adipose fin; no caudal fin; anal fin extremely long, extending from vent to tip of tail (its rays about 200 in number); ventrals moderate, not very far back; pectorals rather long, narrow, inserted high. No axillary scales. Shoulder girdle weak, its uppermost bone (supraclavicle or post-temporal) touching the cranium at the nuchal region, but not connected with it laterally. Air bladder large, simple. Stomach cœcal; pyloric cœca in moderate number; intestines short. Ovaries not closed. Vertebræ very many, 60 + x. Three genera, with about 10 known species. Fishes of the deep sea. (*Halosauridæ*, Günther, Cat. VII, 482, 1868.)

*a.* Ventrals normal; no second dorsal fin.
  *b.* Vertex covered with scales; scales of lateral line scarcely enlarged; snout obtusely rounded; anal high. HALOSAURUS, 292.
  *bb.* Vertex scaleless; scales of lateral line enlarged, provided with photophores; snout pointed; anal moderate. ALDROVANDIA, 293.

## 292. HALOSAURUS, Johnson.

*Halosaurus*, JOHNSON, Proc. Zoöl. Soc. London, 1863, 406, (*oweni*).

Ventrals normal; no second dorsal fin; anal high. Snout obtusely rounded. Head without angular ridges. Vertex covered with scales. Scales of lateral line scarcely enlarged. Characters otherwise included above. (*ἅλς*, sea; *σαῦρος*, lizard.)

*a.* Preoral portion of snout equal to half its length. Height of body nearly equal to half length of head and $\frac{1}{17}$ of total; diameter of eye ⅖ postorbital portion of head and much greater than width of interorbital space; about 60 scales in lateral line in front of vent. OWENI, 905.

*aa.* Preoral portion of snout less than half its length; height of body about ⅓ length of head and $\frac{1}{25}$ of total; diameter of eye half length of postorbital portion of head (which is equal to that of snout), and much greater than width of interorbital space; about 67 scales in lateral line in front of vent. GUNTHERI, 906.

### 905. HALOSAURUS OWENI, Johnson.

Head 7½. B. 14; D. 11; A. 191; P. 11; V. 10; scales about 14–170–6. Height 14⅙ in total length; eye 2 in snout, 5 in head, reaching to profile; snout produced, its preoral portion being nearly ½ its length. Eye rather large, ⅖ postocular portion of head, and much more than width of interorbital space; maxillary reaching vertical from front of eye. Length of head more than its distance from ventral fin, the base of which is entirely in front of and somewhat remote from base of dorsal; pectoral fin with narrow base, very long, extending nearly to root of ventral. Scales of lateral line scarcely larger than the others, without phosphorescent organs being visible in the only specimen known; anterior portion of dorsal fin covered with small scales; anal fin scaleless. Brownish silvery on abdomen. (Günther.) Interorbital space less than long diameter of eye. Snout scaleless. Mouth moderate, not nearly reaching tip of snout. Dorsal fin over the space between ventral fins and vent; longest dorsal rays (second and third) twice as long as base of fin; pectorals scaleless, longer than ventrals; ventrals scaly. Vent in anterior half of total length, no anal papilla; base of anal scaly; caudal of 2 hair-like rays. Lateral line very low down and disappearing posteriorly. Pyloric cœca 12, small. Air bladder 5 inches long and with a delicate silvery coat. Intestine straight. Peritoneum black anteriorly, posteriorly with patches of black lines on a pale ground. The first individual obtained was caught in February, a female with eggs, in 2 masses lying side by side, 5½ inches long, not covered with a sac. (Johnson.) Middle Atlantic, the type from Madeira. Two specimens, 16½ inches and 21 inches in length, were obtained by the *Albatross* at Station 2181, in 693 fathoms. Others obtained by the *Blake* at Stations LXVII, 128–240 fathoms, and LXVIII, 243–458 fathoms, off Guadeloupe and Santa Lucia. (Named for Prof. Richard Owen, the distinguished anatomist.)

*Halosaurus oweni*, JOHNSON, Proc. Zoöl. Soc. Lond., 1863, 406, pl. XXXVI, fig. 2, Madeira; GOODE & BEAN, Oceanic Ichthyology, 131, 1895.

### 906. HALOSAURUS GUNTHERI, Goode & Bean.

D. 11; P. 16; V. I, 9; scales 15–x–5; eye 5. Vertex scaly. Snout produced, its preoral portion contained 2½ times in its length. Eye large, 2 in snout, 2 in postocular portion of the head, and much wider than interorbital space; maxillary reaching nearly to front margin of eye. Length of head less than its distance from root of ventral, the origin of which is slightly in front of that of dorsal, the origin of the dorsal being over posterior portion of root of ventral, and also over the thirty-first scale in the specialized lateral line; two scales between lateral line and origin of ventral; ventral broad, slightly longer than longest dorsal; pectoral fin moderate, extending less than halfway from its own base to root of ventral, 2 in head. Scales on the lateral line not much enlarged, 67 in advance of vent; base of dorsal and anal scaly. Color brownish; under surface of head lighter. A single specimen was obtained by the *Albatross* from Station 2722, 39° 13′ N., 72° W., at a depth of 594 fathoms. (Goode & Bean.) (Named for Dr. Albert Günther.)

*Halosaurus güntheri*, GOODE & BEAN, Oceanic Ichthyology, 131, 1895, Gulf Stream. (Type, No. 38070. Coll. Albatross.)

## 293. ALDROVANDIA, Goode & Bean.

*Aldrovandia*, GOODE & BEAN, Oceanic Ichthyology, 132, 1895, (*rostrata*).

Ventrals normal; no second dorsal fin; vertex scaleless; scales of lateral line enlarged, provided with photophores. Head with pointed snout and prominent lateral ridges. Anal fin moderate, high, its height ⅓ to ¼ that of dorsal. (Named for Ulysses Aldrovandus, of Bologna, the founder of the first natural history museum.)

*a.* Snout much produced (length equal to or greater than distance from eye to root of pectoral); preoral portion of snout exceeds ½ its length; diameter of eye considerably less than width of interorbital space. Twenty-four scales in lateral line in front of vent. ROSTRATA, 907.

*aa.* Snout moderately produced (its length not exceeding postocular portion of head).

*b.* Preoral portion of snout contained 3 times in its entire length; diameter of eye ½ width of interorbital space (⅖ postocular portion of head). About 26 scales in lateral line in front of vent. MACROCHIRA, 908.

*bb.* Preoral portion of snout 3½ in its length; diameter of eye less than ½ width of interorbital space (5 in postocular portion of head). GOODEI, 909.

*bbb.* Preoral portion of snout 2½ in its length; diameter of eye exceeds width of interorbital space (= 2⅔ in postorbital length of head). Dorsal origin behind root of ventral. Eighteen to twenty scales in lateral line in front of vent; slender, depth 20½ in total length. GRACILIS, 910.

*bbbb.* Preoral portion of snout about 2 in its length; diameter of eye equal to width of interorbital space (2⅛ in postorbital length of head). Dorsal origin over base of last rays of ventral. Twenty-seven scales in lateral line in front of vent; stout, depth 15 in total length. PALLIDA, 911.

### 907. ALDROVANDIA ROSTRATA (Günther).

Head 8, much exceeding height of body. D. 9; V. 9; B. 9. Scales 13–24–6. Snout very much produced, spatulate, its preoral portion being more than ½ its length. Eye of moderate size, its length being ⅓ of postocular portion of head, and considerably less than width of interorbital space. Maxillary scarcely reaching front margin of eye. Length of head a little more than its distance from root of ventral, which is nearly entirely situated before the dorsal. Nearly all the scales are lost, but some of the lateral line remain; they are much larger than the other scales; and on the tail, where the lateral line approaches the lower profile, these larger scales fill up all the space between the lateral line and the anal fin. Bones of head very thin; operculum smooth, covered with a very fine membrane. Lower part of side of head occupied from the snout to gill opening by two exceedingly wide muciferous channels, of which one takes its origin on the preorbital, the other on the mandible, and which open behind at the gill opening by a common and very wide aperture. Branchial apparatus as in the other species. Dentition very similar to that of *Aldrovandia macrochir*, but the palatine patches crescent-shaped and rather widely separated from pterygoid band. Scales of lateral line about 3 times size of others, and about 24 in number between gill opening and vent, each bearing a luminous organ, vertically elongated and rhombic, but not extending to upper and lower margins of scales. Light colored, lower part of head and gill cover black; abdominal region blackish. Length 20 inches. One specimen, from *Challenger* Station 63, mid-Atlantic. (Günther.) (*rostratus*, long-nosed.)

*Halosaurus rostratus*, GÜNTHER, Ann. & Mag. Nat. Hist., 1878, II, 252, mid-Atlantic; GÜNTHER, Challenger Report, XXII, 241, pl. LIX, fig. D, 1887.

*Aldrovandia rostrata*, GOODE & BEAN, Oceanic Ichthyology, 132, 1895.

### 908. ALDROVANDIA MACROCHIR (Günther).

B. 12; D. 13; V. 10; P. 11–13. Scales 14 × 5. Snout moderately produced, the preoral portion forming only ⅓ of its length. Eye rather small, ¼ of postocular portion of head, and ½ width of interorbital space. Maxillary reaching to front margin of eye; length of head more than its distance from root of ventral, the origin of which is immediately in front of that of dorsal; pectoral fin with narrow base, very long, extending nearly to root of ventral. Scales of lateral line larger than others, more or less hidden in a pouch of black skin, with a phosphorescent organ at base of free portion; these large scales continued for some length on the tail and cover base of anal fin, which, like the dorsal, is covered in its basal half with small scales; head naked; upper portions of gill cover and cheek covered with scales similar to those of body. Band of premaxillary teeth broader than maxillary band; palatine teeth in two separate patches, each being of an oval shape, with the pointed end directed forward; pterygoid teeth in a very narrow band, which extends far backward in cavity of mouth; basibranchials with a long and broad band. Four well-developed gills. Outer branchial arch with 14 widely-set gill rakers, of which the middle ones are slender and as long as eye, the others becoming shorter toward end of series. Uniform black. Common in the central parts of the Atlantic; first discovered by the *Challenger* off the Strait of Gibraltar, Station V, depth 1,090 fathoms, one specimen, 21½ inches long; near Marion Island, Station 146, depth 1,375 fathoms, four specimens, 18 to 20 inches long. Specimens also obtained by the *Blake*, at Station CCCVIII, at a depth of 1,242 fathoms, and Station CCCXXV, at a depth of 647 fathoms. (*μακρός*, long; *χείρ*, hand.)

*Halosaurus macrochir*, GÜNTHER, Ann. & Mag. Nat. Hist., II, 1878, 251, between Cape of Good Hope and Kerguelen Island.

*Aldrovandia macrochira*, GOODE & BEAN, Bull. Mus. Comp. Zoöl., X, No. 5, 219, 1883.

### 909. ALDROVANDIA GOODEI (Gill).

B. 12; D. I–10, 11; V. I, 8. Snout moderately produced, its preoral portion forming $\frac{2}{7}$ of its own length; eye small, equal to about ⅕ of postocular portion of head, and measuring a little less than ½ of width of interorbital space. Head longer than distance between it and root of ventral. Maxillary reaching vertical of front margin of eye. Dorsal entirely behind ventrals; anal commencing as far behind root of ventrals as the latter are behind the preoperculum; pectorals nearly reach backward to the ventrals. Squamation similar to that of *A. macrochir*. The type of this description was obtained by the *Albatross* at Station 2037, at a depth of 1,731 fathoms. Others were obtained from Stations 2051, 1,106 fathoms; 2035, 1,362 fathoms; 2052, 1,098 fathoms. (Goode & Bean.) (Named for George Brown Goode, one of the most accomplished and scholarly of contemporary ichthyologists, joint author of the Oceanic Ichthyology, from which our accounts of the deep-sea fishes are largely derived.)

*Halosaurus goodei*, GILL, Proc. U. S. Nat. Mus., 1883, 257, Gulf Stream, off Carolina. (Type, No. 33281.)

*Aldrovandia goodei*, GOODE & BEAN, Oceanic Ichthyology, 133, 1895.

### 910. ALDROVANDIA GRACILIS, Goode & Bean.

Head 8½; depth 20½; eye 3 in snout, and about 2½ in postorbital part of head. Very slender, resembling *Aldrovandia rostrata*, from which it differs in having a larger eye, a smaller number of modified scales in lateral line, and in having the vent placed more posteriorly. Distance from end of mouth to tip of snout nearly ⅕ of head; length of snout a little greater than length of mandible; width of interorbital space about ¼ snout and ¾ length of eye; maxilla extending slightly beyond anterior margin of eye; the mandible a little behind end of eye. A few scales in several series behind the eye. Mouth rather large. Teeth on the premaxillaries and mandible in somewhat broader bands than those on the maxilla; vomerine patches broad, well separated in front. Tip of tongue free. Integumentary flap not extending much beyond margin of subopercle. Branchiostegals 10; gill rakers 2 above, 12 below, the longest scarcely half as long as eye. Distance of dorsal from tip of snout 2 in head, length of base ⅔ height of body; longest ray 2½ in head and nearly equal to height of body; about 34 rows of scales in front of dorsal. Ventral entirely in advance of dorsal, its distance from end of head (2 inches) equal to distance from tip of mandible to end of head. Length of ventral (¾ inch) about equal to that of dorsal base, or twice length of eye; origin of ventral about under twenty-eighth row of scales; distance of vent from origin of the ventral greater than length of head, close to anal origin; distance from the dorsal origin to that of the anal (26 inches) 3 times length of dorsal base. Nine or ten enlarged scales in lateral line in front of the ventral origin and about the same number between ventral and vent. Dorsal scaly less than ½ its height; about 12 rows of scales between the dorsal origin and lateral line, and only about 2 rows below lateral line.

Scales silvery, the light orange-brown body color showing through them; branchiostegal membrane bluish; inner surface of gill covers nearly black; inside of mouth bluish. Three specimens known, one obtained by the *Blake*, at Station LXX, off Guadeloupe, 769 fathoms; one at Station 2380, by the *Albatross*, from which the present description is drawn, and another at Station 2381 by the same vessel. Station 2380 is in N. latitude 28° 02′ 30″, W. longitude 87° 43′ 45″, from 1,430 fathoms. Station 2381 is in N. latitude 28° 05′ 00″, W. longitude 87° 56′ 15″, 1,330 fathoms. This species may be identical with *Aldrovandia johnsoniana*, Vaillant, from off the Canaries and the coast of Africa, but the types of the latter species were badly mutilated. (Goode & Bean.) (*gracilis*, slender.)

*Aldrovandia gracilis*, GOODE & BEAN, Oceanic Ichthyology, 134, 1895, off Guadeloupe, and in the Gulf Stream. (Co-type, No. 44327. Coll. Albatross.)

### 911. ALDROVANDIA PALLIDA, Goode & Bean.

Head 7¾; depth 15. Head naked, with the exception of a patch of scales beginning behind eye, its greatest width nearly equal to ½ width of body. Eye midway between tip of snout and head, its long diameter equal to ⅓ length of snout, also equal to interorbital width. Nostrils close to front of eye, the anterior in a short tube, which ends in a little pointed flap; the posterior larger, nearly elliptical in shape; distance from front margin of mouth to tip of snout nearly ½ length of snout. Maxillary extending to below front of eye. Teeth in broad, villiform bands on intermaxilla, mandible, and vomer; in narrower bands on maxilla and palatines. End of tongue barely free. Integumentary flap projecting beyond margin of suboperculum. Dorsal beginning about over end of the base of ventral, its distance from tip of snout a little more than twice length of head; length of its base nearly equal to greatest depth of head; basal half of the fin profusely covered with scales; it consists of 2 simple and 9 divided rays. Longest dorsal ray (1⅕ inches) equals ¾ greatest height of body, last ray ⅖ as long as third. Ventral distant from the snout a space about equal to twice head; it consists of 2 simple and 7 divided rays, the longest equal to base of dorsal; pectoral placed above middle of body, not far from head, its length equal to ½ distance of its base from origin of ventral, and reaching to about seventeenth row of scales. Vent under sixty-third scale of lateral line; about 12 rows of scales between origin of dorsal and lateral line and about 2½ rows between lateral line and origin of ventral; lateral line composed of enlarged and modified scales, becoming obliterated about middle of tail; 15 or 16 of these enlarged scales between head and origin of ventral; about 27 between vent and head; distance from origin of ventral to anus (3 inches) nearly equal to head. Anal rays about 166, their origin not far behind vent; caudal, which is long and slender, with about 4 rays; pectoral 13. Membrane covering anal rays scaled throughout almost its entire length. Gill rakers rather short and few, 3 + 12. Color of scales a light silvery gray, through which the body color appears as a light orange-brown; branchiostegal membrane and opercular bones bluish; inside of gill covers very dark blue. The type, a specimen two feet long, taken in the Gulf of Mexico, 24° 36′ N., 84° 05′ W., by the *Blake* at Station 173, at a depth of 955 fathoms. Many others were obtained in the Gulf Stream, in depths ranging from 679 to 1,430 fathoms, by the *Albatross*. (Goode & Bean.) (*pallidus*, pale.)

*Aldrovandia pallida*, GOODE & BEAN, Oceanic Ichthyology, 134, 1895, Gulf of Mexico. (Co-type, No. 38140. Coll. Albatross.)

## Order V. HETEROMI.

### (THE SPINY EELS.)

The *Notacanthidæ*[*] are separated from the other physostomous fishes by Gill, to form an order which he thus defines:

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[*] Some recent American authors have placed the *Notacanthidæ* with the physoclystous family of *Mastacembelidæ* in the order *Opisthomi* of Cope, originally framed for the latter. There seems, however, to be no evidence, as Dr. Vaillant has lately noted, of affinity between the *Mastacembelidæ* and the *Notacanthidæ*. Vaillant calls attention to the presence of an air duct in *Notacanthus*, and places the family among the Ganoids, between the Sturgeons and the Eels. According to Vaillant (Exped. Sci. Travailleur et Talisman, 324) the dorsal spines in *Notacanthus* differ widely from those of Teleostean fishes in having but a single nourishing canal instead of two. He finds these spines homologous with the plates of sturgeons or rather with the pinnules of the Ganoid genus *Polypterus*, instead of with the spines of the physoclystous fishes. Vaillant also finds many of the skeletal characters of *Notacanthus* very primitive, suggesting Ganoid affinities. At the same time, the simple air bladder, the absence of spiral valve in the intestines and of multiplied valves in the heart seem to ally *Notacanthus* rather to the *Isospondyli* or the Eels. Günther places it among the *Physostomi* between the *Halosauridæ* and the eels, but does not regard it as having close affinities with either.

"Scapular arch formed by the proscapula and post-temporal, the latter detached from the side of the cranium and impinging on the supraoccipital. Hypercoracoid and hypocoracoid coalescing in a single lamellar imperforate plate; actinosts normal. Cranium with the condyle confined to the basioccipital; exoccipital coalesced with epiotics and opisthotics. Vomer obsolete; opercular apparatus complete; preopercle slightly connected with suspensorium; suborbitals suppressed; jaw bones complete and little aberrant; palatines and pterygoids well developed; anterior vertebræ separate; ventrals abdominal." Air bladder with a duct. The character of having the scapular arch free from the cranium and attached to the anterior vertebræ, shared by these fishes with the eels and several other groups may be, in the different cases, of independent origin, and is probably not indicative of any special affinity. (ἕτερος, different; ὦμος, shoulder.) (*Heteromi*, Gill, American Naturalist, November, 1889, 1016).

*a.* Jaws normal; dorsal spines separated; both jaws with teeth. NOTACANTHIDÆ, LXXXVII.

*aa.* Jaws forming a suctorial mouth, with modified rami; no teeth. Dorsal spines close together, united by membrane to form a high triangular fin. LIPOGENYIDÆ, LXXXVIII.

## Family LXXXVII. NOTACANTHIDÆ.

Body elongate, somewhat compressed, ending in a band-like, tapering tail. Scales small, cycloid. Dorsal represented by a series of short spines with few or no soft rays. Anal fin of many rays, the anterior ones being spinous; ventrals abdominal, with more than five soft rays, and usually one or two spines. Jaws normal; mouth inferior, the snout projecting beyond it, the lower jaw meeting the palate as in sharks. Jaws and palatines armed with a series of close-set teeth; palatines movable; vomer wanting. A sharp spine more or less hidden by the fleshy folds of the lips at angle of mouth, on each side. Shoulder girdle loosely suspended to the skull by ligaments. Air bladder present, with a pneumatic duct.* Gills 4; gill openings wide, not restricted above, the membranes separate, free from the isthmus. Pseudobranchiæ absent. Gill rakers long and slender. Ovaries without oviducts. Deep-sea fishes, found in most seas. Genera about 5; species about 12. This is an archaic group, and, as already stated, its relationships are still doubtful. (*Notacanthi*, Günther, Cat., III, 544, 1861.)

NOTACANTHINÆ:

*a.* Dorsal spines 6 to 12; teeth in upper jaw compressed and obliquely triangular.

*b.* Origin of spinous dorsal far in advance of vent; mouth lateral with the lip continuous. NOTACANTHUS, 294.

POLYACANTHONOTINÆ:

*aa.* Dorsal spines 27 to 38. Teeth in jaws erect, fine; ventrals separated.

*c.* Snout not very elongate, not proboscis-like; dorsal and anal spines low and strong, the latter 50 or more in number; lateral line straight. MACDONALDIA, 295.

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*According to Vaillant; Günther, however, does not find a duct in *Notacanthus sexspinis*.

## 294. NOTACANTHUS, Bloch.

*Notacanthus*, Bloch, Abhandl.* Böhmischen Gesellsch. Wissenschaft, I, 278, 1787, (*chemnitzii*).
*Acanthonotus*, Bloch, Ichthyologia, XII, 113, 1797, (*nasus*).
*Campylodon* (Fabricius, 1793), Reinhardt, Vid. Selsk. Afh., 120, 1838, (*fabricii*).

Dorsal spines 6 to 12. Teeth in upper jaw compressed, obliquely triangular. Lip normal, continuous. Ventrals connate or confluent. Characters otherwise included above.

*a.* Body much higher over ventrals than over pectorals, and comparatively short. Lateral line following profile of back in front of dorsal spines, then sinking to median line of body.
  *b.* First dorsal spine behind vertical from axil of ventral. D. X to XI; A. XIII to XIV. CHEMNITZII, 912.
  *bb.* First dorsal spine in front of vertical from insertion of ventral. D. XI; A. XVII. ANALIS, 913.
*aa.* Body little higher over ventrals than over pectorals, and comparatively elongate.
  *c.* Lateral line slightly arched above pectoral, sinking to median line of body in advance of first dorsal spines. Last dorsal spine over fifth from last anal spine; fins low; D. X; A. XIX. PHASGANORUS, 914.

### 912. NOTACANTHUS CHEMNITZII,† Bloch.

Head 8; depth 10. D. XI; A. 15+118; P. 19; V. 3+7, left side, (8 right side). Branchiostegals 8 or 9. Body elongate, its greatest height

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[*] Concerning this rare and almost forgotten paper of Dr. Bloch, our friend Dr. Franz Hilgendorf of the University of Berlin, writes us:

"Über zwey merkwürdigen Fischarten von Herrn D. Bloch." "Abhandlungen der Böhmischen Gesellschaft der Wissenschaften," auf das Jahr 1787, oder Dritter Theil, Prag u. Dresden, 1788, pp. 278–282.

Der erste der beiden Fische ist "Der Hackelrücken, *Notacanthus chemnitzii*, zehn Hackeln am Rücken. *Notacanthus* aculeis decem dorsalibus."

Bloch schreibt hier, *Notacanthus*, nicht *Notocanthus* (wie in der deutschen Ausgabe seiner Naturgeschichte der Ausländischen Fische, 1795) oder *Acanthonotus* (wie in der französischen Ausgabe, 1797,; dieser letzen Schreibweise folgt Bloch–Schneider.

Im Texte der Abhandlung sagt Bloch, dass er das Exemplar von Chemnitz in Kopenhagen erhielt und dass der Fisch "ist ein Bewohner des Nordmeers." Die farbige Tafel weicht mehrfach ab von der Tafel 431 der Naturgeschichte Ausländische Fische. So ist die Caudalis von der Analis durch eine Lücke getrennt. Die Pectoralis ist kürzer gezeichnet; es sind Zahlen beigesetzt; beide D. "10," unter der P. "17," unter der A. $\frac{13}{125}$. Im Texte sagt er "An diesem Fische sieht man nur 6 Flossen wahr, 2 an der Brust; ebensoviel am Bauche, am After und Schwanze, an jedem eine. In der Pectoralen flosse zähle ich 17, in der Bauchflosse 8, und in der Schwanzflosse 9 vielverzweigte Strahlen. Die Afterflosse aber hat 13 Stachlichte und 113 einfache Strahlen." Die sonstige Beschreibung ist kurz und nichts wichtiges bringend.

Merkwürdig ist, dass Bloch in der Naturg. Ausl. Fische diese erste Arbeit nicht erwähnt und den *Notocanthus* als ein neues Genus wieder aufführt. Es entsteht die Frage ob überhaupt sein *N. chemnitzii* dasselbe sein soll wie der angeblich aus Indien stammen de *nasus*.

Das Berliner Museum hat nur ein Exemplar von Bloch. Ich habe es neulich auf Goode's Wunsch nachuntersucht. Meine Zahlen sind Rad. Branch. 8–9. D. $\frac{11}{0}$; A. $\frac{15}{118}$; C. ?; P. 19; V. $\frac{3}{7}$–8. Die P. ist abgestossen und vielleicht schon bei Bloch's Lebezeiten so gewesen.

Ich möchte glauben, dass die frühere Zeichnung mangelhafter war, und dass beiden Publicationen dasselbe Exemplar zu Grunde lag. Vielleicht hat Chemnitz nicht gewünscht dass seine Beziehung bei Bloch publicirt würden. Die Bearbeitung und Abhandlung des andern Fisches (*Silurus militaris*) erwähnt Bloch übrigens in seinem grossen Werk, auch nicht.

In dem Handschriftliche Katalog von der Sammlung Bloch's steht nur ein Exemplar, als Nummer 560, und als LXXVIIItes Geschlecht mit der Bezeichnung "*Notacanthus chemnitii*" (ohnez). (Hilgendorf in lit., February 10, 1894.)

[†] "The material now classed by authors under the name of *N. nasus* is the following: (1) A specimen described by Fabricius in 1798 under the generic name of *Campylodon*, obtained in 1794 from Greenland; (2) Bloch's type in the Berlin Museum, believed by him to come from the West Indies, described under the names *Notacanthus chemnitzii* and *Acanthonotus nasus*; (3) A specimen obtained off Iceland by *La Recherche* and brought by Gaimard to the Paris Museum, figured in the Règne Animal, and said to have been figured also in the Voyage in Scandinavia. This, as has already been stated, is possibly a typical *N. nasus*; (4) A specimen, 3 feet long, obtained in South Greenland, and brought in 1877 to the Copenhagen Museum. This also is possibly not a characteristic representative of the species. Both Canestrini and Giglioli enumerate *Notacanthus nasus* among Mediterranean fishes, but entirely without authority."—*Goode & Bean.*

about 4½ times in distance from vent to tip of snout. Head short, compressed, its length not quite 3½ times in distance from vent to snout. Mouth large; maxillary nearly reaching vertical from anterior margin of pupil. Mouth entirely on under portion of head, sublateral. Thirty-five teeth in premaxillaries on each side. Distance between upper profile of head and eye about equal to diameter of eye; and diameter of eye between ½ and ⅓ length of snout, and about 8 in head. Gill cover divided to below the symphysis of operculum (with hyomandibular), free from isthmus. Scales lacking only about mouth and eyes; about 40 longitudinal rows of small scales between ventral outline and lateral line; smooth and imbricated. First dorsal spine very small, only visible as a point; placed close to this is the second, which is also very short and feeble; third, though also short, is thicker. The vent lies behind fifth spine. First anal spine immediately behind vent, and very small, not extending beyond profile; second and third but slightly; the spines which are longest and placed farthest back still bear traces of a connecting membrane and are probably only worn-off rays; pectorals inserted somewhat farther back from the gill covers than shown by Bloch, their base less than ⅙ the length of head; ventral fins connected behind the median line by a membrane, terminating considerably in advance of vent. Total length (restored) 34 inches. Length of tail about 18½ inches. (Hilgendorf, in letter to Goode & Bean.) (Named for "Chemnitz" of Copenhagen, probably a collector or dealer in curiosities, 1787.)

*Notacanthus chemnitzii*, Bloch, Abh. Böhm. Gesellsch. der Wissenschaft., I, 278, 1787, Northern Sea; Jordan & Gilbert, Synopsis, 370, 1883.

*Notocanthus nasus*, Bloch, Ichthyologia, XII, 113, pl. 431, 1795, "India;" Günther, Cat., III, 54, 1861; Goode & Bean, Oceanic Ichthyology, 164, 1895.

*Campylodon fabricii*, Reinhardt, Vidensk. Selsk. Afhandl., 120, 1838, Greenland.

*Acanthonotus nasus*, Bloch, Ichthyologia, XII, 114, 1797, Ed. Fr.

### 913. NOTACANTHUS ANALIS, Gill.

D. XI; A. XVIII. Body much higher over ventrals than over pectorals, and comparatively short, its height equal to ⅓ distance from vent to tip of snout and nearly equal to head; lateral line arcuate in front of dorsal spines, following profile of back and then sinking to median line of body. First dorsal spine in front of ventral. Snout compressed, pointed, much produced beyond mouth; the cleft extends nearly to vertical through middle of eye; length of snout 1½ times diameter of eye; width of interorbital area slightly less than eye; projection of snout beyond mouth equal to eye or nearly so; snout compressed, not swollen. Mouth narrow, transverse, its width about ¼ head. Eye placed some distance below the upper profile and in line of lateral line continued to the nostrils. Gill opening wide, the membranes confluent and slightly in advance of vertical from the upper end of gill opening; not attached to isthmus. Scales very minute, imbricated, adherent. Dorsal spines short, the anterior very short; the second and first nearly over the origin of ventrals, the fifth above vent, and the sixth slightly behind origin of anal; the longest about ½ as long as the eye; the last (eleventh), which is followed by a single ray attached to it by membrane, over the fifteenth spine of anal; dorsal spines distant from each other, and behind each is a narrow angular membrane; anal beginning immediately behind vent, and in its middle portion considerably elevated; length of its longest rays about equal to snout, from which point it slopes rapidly to tip of tail. Pectoral placed high up in axis of body, inserted at some distance behind gill openings, broad and nearly oval in shape; ventrals confluent, some distance in advance of vent; stout, broad, ovate in form, not extending to vent, but separated from it by a distance equal to half their own length. Color, uniform light brown. This description is from the types of Gill, (Type, No. 37856), from *Albatross* Station 2677, in 478 fathoms. The types, two in number, measure 11½ and 12¼ inches, respectively. Another specimen, (No. 44246, U. S. N. M.) was obtained by the *Albatross* from station 2676, at a depth of 407 fathoms. (*analis*, pertaining to the anal fin.)

*Notacanthus analis*, Gill, Proc. U. S. Nat. Mus., 1883, 255, Gulf Stream, latitude 40° N., longitude 69° W.; Goode & Bean, Proc. U. S. Nat. Mus., 1894 (1895), 459, and in Oceanic Ichthyology, 165, 1895.

### 914. NOTACANTHUS PHASGANORUS, Goode.

Head 7½; depth 9. D. X; A. XIX, 130; P. about 17; V. II, 9; B. 8; scales about 20–400–36. Body much compressed, its greatest width about ⅓ its height. Head everywhere covered with very small scales, its bones very flexible, but protected by leathery skin. Interorbital width more than length of snout, 4 in head, twice diameter of eye. Mandible twice length of eye; maxillary considerably greater. Teeth of upper jaw slender, blunt, close-set, and comb-like, 32 on each side; teeth of lower jaw shorter, slenderer, in 2 rows; palatines with villiform teeth, in about 2 series. Distance from snout to dorsal 2¾ times length of head, its length nearly twice length of head; anal beginning close behind vent, its length half the body. Pectoral short and rounded, its length (uncertain) about ⅓ the head. Ventrals broad, with peduncle-like bases thickly covered with scales; closely adjacent, separated by a narrow groove. Length 3 feet. Grand Banks, Newfoundland. (Goode.) One large specimen known, taken from the stomach of a *Somniosus microcephalus*. (*φάσγανον*, sword; *ὅρος*, boundary, used for *οὐρά*, tail.)

*Notacanthus phasganorus*, Goode, Proc. U. S. Nat. Mus., III, 1880, 535, Grand Banks of Newfoundland; (Type, No. 25972. Coll. Capt. Briggs Gilpatrick); Jordan & Gilbert, Synopsis, 900, 1883; Goode & Bean, Proc. U. S. Nat. Mus., 1894 (1895), 462, and in Oceanic Ichthyology, 167, 1895.

## 295. MACDONALDIA, Goode & Bean.

*Macdonaldia*, Goode & Bean, Proc. U. S. Nat. Mus., 1894 (1895), 467, and in Oceanic Ichthyology, 172, 1895, (*rostrata*).

Body elongate, covered with minute, imbricated scales. Head scaly. Mouth inferior. Dorsal fin represented by numerous short, straight, robust, and disjointed spines, 27 to 35 in number, the first in advance of the insertion of the pectoral. Anal as in *Notacanthus*, but lower and with a longer portion of low, short, slightly curved, disjoined spines, from 35 to 55 in number, which, under the final dorsal spines, pass into flexible rays. Lateral line straight, conspicuous. Pectorals moderate, placed far back, below the middle line of the body, and remote from the lateral line. Teeth in jaws erect, small, and also in series on the vomer and palate. A line of pores on the inner edge of the mandible. Ventrals moderate, entirely separate. (Named for Col. Marshall McDonald, United States Commissioner of Fish and Fisheries, "in commemoration of his liberal policy in furthering ichthyological research.")

*a.* Dorsal XXVIII; anal XLII or XLIII. ROSTRATA, 915.
*aa.* Dorsal XXXV; anal about XL. CHALLENGERI, 916.

### 915. MACDONALDIA ROSTRATA (Collett).

D. XXVIII; A. XLII or XLIII. Body greatly compressed, its outlines tapering rapidly in both directions from origin of vent, its greatest height 3½ times in distance of vent from tip of snout, or about ⅘ length of head, which is 9½ times in the total; snout compressed, pointed, snake-like, produced beyond the mouth a distance less than diameter of eye, 3 in head. Mouth small, its cleft scarcely reaching to the anterior nostril. Each jaw armed with a series of minute teeth and a similar series on vomer and palate. Eye moderate in size, placed not far from dorsal profile, distant about 2½ diameters from the end of snout, more than 3 diameters from end of opercle. Gill opening wide. The body and head covered by minute, imbricated scales; a line of mucous pores extending from anterior end of lateral line forward under the eye to end of maxillary. Dorsal spines short, distant from one another, the first being over end of opercle, fifth slightly behind origin of pectoral, the twelfth slightly in advance of origin of pectoral, the fifteenth almost over origin of anal, and the last (twenty-eighth) a little behind middle of length of tail. In another individual the fourth spine is immediately over the pectoral insertion, the thirteenth over the ventral origin; the whole number of spines is 30, but there is behind the thirtieth a minute spine almost united by membrane. Anal beginning immediately behind the vent; after the fifth spine the height of the fin remains uniform until the length of the rays gradually decreases near tip of tail; pectoral inserted at a distance from the gill opening nearly twice its own length; ventrals with a broad base, not confluent, and reaching to vent or slightly beyond it.

Specimens obtained by the *Albatross* at Station 2216, in 963 fathoms, 16½ and 16 inches long. Another specimen, 17 inches long, was obtained by the *Albatross* at Station 2553, in 551 fathoms. The *Hirondelle* took it off Newfoundland, in 633 fathoms. (*rostrata*, long-nosed.)

*Notacanthus rostratus*, COLLETT, Bull. Soc. Zoöl. France, 1889, 307, off Newfoundland.
*Macdonaldia rostrata*, GOODE & BEAN, Proc. U. S. Nat. Mus., 1894 (1895), 467, pl. 18, fig. 2, and in Oceanic Ichthyology, 173, figs. 189, and 195 A and B, 1895.

### 916. MACDONALDIA CHALLENGERI (Vaillant).

Head 3; depth 5. D. XXXV; A. about XL, 140; B. 6; C. 5; P. 11; V. I, 9. Greatest depth of body opposite vent, and ⅕ of distance of vent from end of snout; length of the long, narrow, compressed head ⅓ of the same length. Snout compressed, pointed, much produced beyond the narrow mouth, the cleft of which laterally extends to below posterior nostril; each jaw armed with a series of fixed minute teeth; a similar palatine series within the intermaxillary series; the mandibular series fits between the upper two rows. Eye close to the upper profile, 2 diameters from end of snout, and 4 from extremity of opercle, its diameter greater than interorbital width. Gill opening wide; gill membranes supported by very slender branchiostegals, confluent in front, and not attached to the isthmus. The whole body and head are covered by minute, smooth, imbricate, and adherent scales. All the dorsal spines short, distant from one another, the first being above root of pectoral, the last behind middle of length of tail; anal spines commencing immediately behind vent, and very gradually and but slightly increasing in length behind, passing finally into flexible rays of varying and indefinite number; pectorals inserted some distance behind the gill opening, with very narrow base; ventrals close to, but not extending to, the vent; entirely separate. Color uniform light brown, blackish about the gills and on the soft anal fin. Teeth minute, those of the upper jaw scarcely different in size or shape from those of the lower, 31 on each side of the upper and 23 on each side of the lower jaw, 21 in each half of the palatine series; each ramus of the mandible with a series of pores which is continued on the preoperculum. The union of the gill membranes takes place opposite middle of distance between orbit and occiput; orbit without circular fold. Gill cavity and peritoneal sac with a thin layer of black pigment. Air bladder much smaller than in *Notacanthus sexspinis*, occupying a small portion of middle of abdominal cavity; anteriorly on the left side it is prolonged into a narrow cylindrical horn about $\frac{2}{3}$ length of its body; there is no open communication between it and the intestinal duct. The ovaries are a pair of band-like bodies, transversely plaited and without oviduct. The intestine makes only 1 convolution; pyloric appendages represented by 3 short diverticula only. Kidneys confluent into 1 short body which is situated between the muscles of the tail behind the vent. (Günther.) North Pacific. The type, 16 inches long, dredged by the *Challenger* at Station 237, south of Yedo, in 1,875 fathoms. A second specimen, 20 inches long, obtained by Dr. Gilbert (*Albatross* explorations), in Bering Sea, west of the Pribilof Islands, in 1,625 fathoms, at Station 3,308. (Named for Her Majesty's Ship *Challenger*, employed in deep-sea research by the Government of Great Britain.)

*Notacanthus rissoanus*, GÜNTHER, Fishes Challenger, XXII, Part LVII, pl. LXI, fig. B, 1887; not of FILLIPI & VÉRANY, Mem. Acc. Sci. Torino, XVIII, 190, 1859, whose specimen came from the Mediterranean.

*Notacanthus challengeri*,* VAILLANT, Expedition Travailleur et Talisman, 1888, south of Yedo; based on GÜNTHER's description.

*Macdonaldia challengeri*, GOODE & BEAN, Oceanic Ichthyology, 172, 1895.

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[*] "Vaillant was perfectly justified in separating this Pacific form from the Mediterranean *Polyacanthonotus rissoanus*, with which Günther had identified it. The lower heavier spines in both dorsal and anal fins, the more anterior origin of the dorsal, which is a little in advance of base of pectorals, the very short robust ventral spine, and the lower insertion of pectoral fin sufficiently distinguish the species, in addition to the peculiarities in the shape of the snout and the greatly increased number of anal spines to which Vaillant calls attention.

"Günther's description, above cited, of the fish taken south of Yedo at a depth of 1,875 fathoms, agrees so well with our specimen that no doubt can exist of their identity. The maxillary spine not shown in Günther's figure, is very evident in our specimen. The branchiostegal rays are distinctly 6 instead of 5 in number, and the caudal contains 5 instead of 6 rays. There are 35 dorsal spines. The anal spines pass so gradually into the rays that they are distinguishable with difficulty. Definite articulations appear before the rays have lost their spinous character, while still stiff and pungent. Dividing them on the basis of these articulations, the anal fin contains 40 spines and about 140 soft rays." (Gilbert, MS.)

## Family LXXXVIII. LIPOGENYIDÆ.

Heteromi with a roundish, inferior, suctorial mouth, imperfect lower jaw* with its rami separated at middle, connected with the corresponding sides of the upper jaw, and invested in a thick, transversely plicated, horseshoe-shaped lip, reflected upward behind on the cheeks; no teeth; short row of 4 or 5 partially connected graduated dorsal spines and 5 to 7 branched rays, forming a regular fin. (Gill.) (*Lipogenyidæ*, Gill, in Goode & Bean, Proc. U. S. Nat. Mus., 1894 (1895), 469.)

### 296. LIPOGENYS, Goode & Bean.

*Lipogenys*, GOODE & BEAN, Proc. U. S. Nat. Mus., 1894 (1895), 469, and in Oceanic Ichthyology, 173, 1895, (*gillii*).

Head and body compressed, the body elongate, as in *Notacanthus*. Snout produced, compressed, obtuse at tip. Cleft of the mouth inferior, suctorial, circular in front, surrounded by rugose, contractile lip, with cleft posteriorly, flanked by wing-like flaps, containing the modified mandibular bones, which articulate with the end of the maxilla and are free behind. A concealed spine at the end of the maxilla. No teeth. Anterior nostril in short tube, the posterior oblong, under a short flap. Dorsal fin short, but normal and well developed, with a distinct soft portion; anal fin normal in position, high, with many spines, and with some of the rays spine-like, though forked; a distinct, though very small, caudal fin; ventrals normal, well developed, with several spines. Scales minute, very numerous; lateral line conspicuous. (λείπω, to leave off; γένυς, jaw.)

#### 917. LIPOGENYS GILLII, Goode & Bean.

Head 8⅔; depth 10; eye 5; snout 4; interorbital width 5 in head. D. V, 5; A. XLI, 88; V. III, 7. Body compressed, its greatest width ½ its height. Postorbital portion of head twice as long as snout. Diameter of circular opening of mouth about ½ diameter of eye. Dorsal fin inserted at a distance from snout equal to about 3 times length of head. It consists of 5 graduated spines, of which the first is minute, and the longest as long as snout, and 5 soft rays, of which the second is longest, nearly ½ as long as head; the spines and rays are all compactly arranged in a strong, triangular fin; length of dorsal base ½ that of head; anal beginning under fourth spine of dorsal, of 41 spines and 88 rays, of which the anterior 10 are stiff, though articulated, and divided at the tip; longest ray longer than longest spine, about as long as snout; ventral fins almost meeting in the median line, reaching vent but disconnected; distance of ventral from tip of snout about 2½ times length of head; pectoral placed below median line of body, at a distance from head about equal to diameter of eye, its length a little greater than postorbital part of head. Lateral line well developed anteriorly, becoming obsolete at a distance from end of dorsal about equal to 2½ times head. Color uniform light brown; under side of gill covers dark, showing dark at the edges of the opercular bone. Type 17 inches long. (Named for Dr. Theodore Gill, to whose critical insight the advance of systematic ichthyology in America is largely due.)

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* "The anomalous and unexampled modification of the lower jaw and mouth deserves a detailed anatomical examination, but the existence of only one specimen—for the present, at least—is deemed sufficient to render such an investigation inadvisable."—*Goode & Bean.*

*Lipogenys gillii*, GOODE & BEAN, Proc. U. S. Nat. Mus. 1894 (1895), 469, pl. 18, fig. 3, and in Oceanic Ichthyology, 173, 1895, Albatross Station 2742, Gulf Stream, from a depth of 805 fathoms. (Type No. 39212. Coll. Albatross.)

## Order W. XENOMI.[*]

Coracoids represented by a cartilaginous plate, imperfectly divided; pectoral fin without actinosts. Skeleton very thin and papery. Post-temporal imperfectly ossified. Otherwise essentially as in the *Haplomi.* One family, confined to the fresh waters of the Arctic regions, a primitive type, allied to the *Haplomi*, but with the base of the pectoral fin extremely simple in structure. (ξένος, strange; ὦμος, shoulder.)

### Family LXXXIX. DALLIIDÆ.

### (THE ALASKA BLACKFISHES.)

Body oblong, covered with small, partly embedded cycloid scales; lateral line rudimentary; a line of mucous tubes below eye. Eye small;

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[*] Dr. Gilbert has examined the anatomy of *Dallia*, and makes the following observations:

"The characters assigned by Dr. Gill to his order *Xenomi*, of which *Dallia* is the sole representative, seem to need some modification. The group is thus defined by him:

"'Teleosts, with the scapular arch free from the cranium laterally, and only abutting on it behind, coracoids represented by a simple cartilaginous plate without developed actinosts, and with the intermaxillary and supramaxillary bones coalescent.'

"The last of these three characters we have not been able to verify, as the premaxilla, while lying closely appressed to the maxilla, is readily separated from it, the two being in no sense 'coalescent.' The expression 'scapular arch free from the cranium laterally' refers to the simple nature of the post-temporal, which is attached, as usual, to the epiotic, but seems at first sight to lack entirely the inner fork to join the parotic process of the cranium. Closer examination shows, however, that a strong ligament replaces the lacking arm, and answers to it in all its relations. We find, furthermore, that while extending in some specimens the entire distance between the opisthotic and the simple post-temporal, in others the outer portion of the ligament is more or less ossified, the bony rod thus formed being an integral part of the post-temporal, and representing the proximal portion of the missing fork. As stated, this ossification invades the ligament to a varying extent in different specimens. In at least two which have come under our observation, the fork of the post-temporal thus formed has extended almost the entire distance across to the opisthotic, the shape and relations of the bone being then entirely normal and usual. It is evident that this character is not of high taxonomic value, and would not of itself warrant any very wide separation of *Dallia* from what are apparently its nearest relatives. The case is different, however, when we come to examine the coracoid portion of the shoulder girdle. As stated by Dr. Gill, we deal here with a cartilaginous plate in which no ossifications occur, and which is followed immediately by the fin rays, without the intervention of actinosts. This coracoid cartilage is an extremely thin and delicate imperforate lamina, usually exhibiting very distinct division into upper and lower halves, which may be taken to represent the hypo- and hypercoracoid elements. In its distal third, the plate begins to break up, by longitudinal subdivision, into a fringe of narrow cartilaginous strips. These approximately equal in number the pectoral rays, and join the latter directly, the basal portion of each pectoral ray forking slightly to receive the tip of the cartilaginous strip.

"In the deep-sea spiny eels of the genus *Notacanthus*, there is a somewhat similar condition of the coracoid elements, inasmuch as the hypo- and hypercoracoid, though present, are merely shell-like rudiments surrounded by cartilage, and the actinosts are geatly reduced. It seems probable that we are dealing in the two cases with independent degenerations of the shoulder girdle, and that the two groups are not really related." (Gilbert, MS., September 20, 1894.)

cleft of mouth moderate; lower jaw much projecting; lateral margin of upper jaw formed by the slender, toothless maxillaries. Teeth villiform or almost cardiform on jaws, vomer, and palatines; those on premaxillaries enlarged. Shoulder girdle free from the skull laterally, the lower branch of the post-temporal imperfectly ossified. Dorsal short, without spines, inserted before anal; ventrals abdominal, inserted in front of dorsal, each composed of 3 rays; base of anal about as long as that of dorsal; caudal fin rounded, with many slender rays; pectoral fin rounded, with a somewhat fleshy base, with 33 to 36 rays, the structure of the base peculiar, the hypercoracoid and hypocoracoid being undifferentiated, represented by a cartilaginous plate, and no actinosts developed. Vertebræ 42. Skeleton everywhere thin and papery. Superior pharyngeals all separate; first and second without teeth; third and fourth with teeth. Lower pharyngeals separate. Branchiostegals 7 or 8. Streams of Alaska and Siberia, one species known; a very singular fish, apparently an ancient type.

(*Dalliidæ*, GILL, Smithsonian Report for 1883 (1885), 728.)

## 297. DALLIA, Bean.

*Dallia*, BEAN, Proc. U. S. Nat. Mus., 1879, 358, (*pectoralis*).

Characters of the genus included above. (Named for Dr. William Healey Dall, its discoverer, well known as a naturalist and explorer.)

### 918. DALLIA PECTORALIS, Bean.

(ALASKA BLACKFISH; CHORNIA RYBA.)

Head 4¼; depth 4 to 4½; eye small, 6 or 7. D. 12 to 14; A. 14 to 16; P. 33 to 36; V. 3; scales 11–77–11; B. 7 or 8. Body rather elongate. Pectoral about half as long as head; ventral ⅓; anal beginning opposite front of dorsal and ending nearly opposite its last ray. Scales on belly very small. Length 8 inches. Streams and ponds of northern Alaska and Siberia; abounding in sphagnum ponds; found in countless numbers "wherever there is water enough to wet the skin of a fish;" forming the chief food of natives. The species feeds on plants and worms. Its vitality is extraordinary. Blackfishes will remain frozen in baskets for weeks and when thawed out are as lively as ever. Turner describes one swallowed frozen by a dog, thawed out by the heat of the stomach, and vomited up alive. (*pectoralis*, alluding to the broad pectoral fins.)

*Dallia pectoralis*, BEAN, Proc. U. S. Nat. Mus., 1879, 358, **St. Michael's, Alaska.** (Type, No. 23498. Coll. L. M. Turner.) JORDAN & GILBERT, Synopsis, 351, 1883; TURNER, Contr. Nat. Hist. Alaska, 100, pl. 9, 1886.

*Umbra delicatissima*,[*] SMITT, Øfver. Kongl. Vetensk Akad. Fφrh. Arg. Stockholm, 38, pl. 5, fig. 1, 1881, **Pittlekaj, Siberia.**

*Dallia delicatissima*, SMITT, in Nordenskjold's Voyage of the Vega, II, 59, with plate, 1881.

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[*] The following is Dr. Smitt's original notice of *Dallia delicatissima*, for which we are indebted to the kindness of Mr. Barton A. Bean:

"Hr. Smitt gaf en beskrifning af hundfiskarnes (umbridernas) byggnad och lefnadssätt, med särskild hänsyn till en af Vega-expeditionen fran färskvattens-lagunerna vid Pittlekaj hemförd ny art, *Umbra delicatissima.*"

## Order X. HAPLOMI.*

### (The Pike-like Fishes.)

Soft-rayed fishes with the mesocoracoid wanting, the coracoids normally developed, and the post-temporal normally attached to the cranium. Parietal bones separated by the supraoccipital. Symplectic present. Opercular bones well developed. Anterior vertebræ unmodified. Scapular arch joined to the cranium by a post-temporal. Hypocoracoid and hypercoracoid separate, with developed actinosts. Pharyngeal bones distinct, the superior directed forward, 3 or 4 in number, the inferior not falciform. No interclavicles. Mouth with teeth. Air bladder with a distinct duct. Ventral fins abdominal, rarely wanting; pectoral fins placed low; dorsal fin more or less posterior, the first ray occasionally stiffened and spine-like; no adipose fin. Head usually covered with cycloid scales like those on the body. Species chiefly inhabiting fresh water. This order is, in some regards, intermediate between the *Isospondyli* and the *Acanthopteri*. Part of its species, at least, are remnants of a more ancient fauna than now inhabits the same waters. (ἁπλόος, simple; ὦμος, shoulder, in allusion to the want of the mesocoracoid, in which respect these fishes resemble the more specialized spiny-rayed forms, rather than the other soft-rayed fishes.) (*Physostomi*, part (families *Esocidæ*, *Umbridæ*, *Cyprinodontidæ*, and *Heteropygii*), Günther, Cat., VI, VII.)

*a.* Lateral margin of upper jaw formed by the maxillaries; premaxillaries not protractile; vent normal.
  *b.* Teeth villiform, equal; jaws not produced. UMBRIDÆ, XC.
  *bb.* Teeth cardiform, unequal; jaws depressed and produced; basis of cranium double. LUCIIDÆ, XCI.
*aa.* Lateral margin of upper jaw formed by the premaxillaries; basis of cranium simple.
  *c.* Vent normal, abdominal; premaxillaries extremely protractile. PŒCILIIDÆ, XCII.
  *cc.* Vent close behind the isthmus; premaxillaries little protractile. AMBLYOPSIDÆ, XCIII.

## Family XC. UMBRIDÆ.

### (The Mud Minnows.)

Body oblong, broad anteriorly, compressed behind. Head large, flattened above. Mouth moderate, with bands of villiform or cardiform teeth on premaxillaries, lower jaw, vomer, and palatines; premaxillaries not protractile; lateral margin of upper jaw formed by the broad, short maxillaries, which are toothless and without distinct supplemental bone; lower jaw the longer. Gill openings wide, the membranes scarcely connected; gill rakers little developed; branchiostegals 6 to 8. Scales moderate, cycloid, covering head and body; lateral line wanting. Dorsal fin moderate, posterior, in advance of anal; ventrals small, close to anal; pectorals inserted low; caudal fin rounded. Stomach without blind sac; no pyloric cœca; pseudobranchiæ hidden, glandular; air bladder simple. Oviparous fishes, the sexes similar. Carnivorous fishes of small size, living in mud or among weeds at the bottom of clear, sluggish streams and ponds; extremely tenacious of life, like the *Pœciliidæ*. One genus with 3 species, (*Umbra crameri* of Austria, and the following). The family is near to the *Luciidæ*, differing mainly in the smaller mouth and weaker teeth. Like *Dallia*, *Percopsis*, *Aphredoderus*, *Chologaster*, and other associated American fresh-water forms, *Umbra* must be regarded as an archaic type, characteristic of some earlier fish-fauna. (*Umbridæ*, Günther, Cat., VI, 231, 232, 1866.)

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* In Dr. Gill's latest arrangement, the groups or orders here called *Haplomi*, *Synentognathi*, and *Acanthopteri* (exclusive of *Plectognathi*) are united to form the order *Teleocephali*. As thus limited the order would include those typical fishes in which the mesocoracoid is absent, and which do not show the special peculiarities of the *Pediculati* and the *Plectognathi*. In earlier papers of Dr. Gill the *Isospondyli* (*Malacopteri*) and the *Ostariophysi* are likewise included. The removal of the *Ostariophysi* is doubtless a step in advance, but the distinctions between the *Isospondyli* and the *Iniomi* and *Haplomi* are not of the most profound character, nor are the *Plectognathi* fundamentally different from the *Acanthopteri*. There seems to us no special advantage in the retention of a central order *Teleocephali*, from which the divergent branches are separated as distinct orders.

While our knowledge of the osteology and embryology of most of the families of fishes is very incomplete, it is evident that the relationships of the groups can not be shown in any linear series, or by any conceivable arrangement of orders and suborders. The living teleost fishes have sprung from many lines of descent, their relationships are extremely diverse, and their differences are of every possible degree of value. The ordinary schemes have magnified the value of a few common characters, at the same time neglecting other differences of equal value. No system of arrangement which throws these fishes into large groups can ever be definite or permanent.

### 298. UMBRA (Krämer) Müller

(MUDFISHES.)

*Umbra*, KRÄMER, Anim. Austr. Infer., 1756; MÜLLER, Abhandl. Akad. Wiss. Wien. Berl., 188, 1842, (*crameri*).

*Melanura*, AGASSIZ, Amer. Journ. Sci. Arts, 1854, 135, (*annulata*, etc., =*pygmæa*).

Body oblong, covered with cycloid scales of moderate size, without radiating striæ; no lateral line. Head shortish, little depressed. Eye rather small. Cleft of mouth moderate. Ventral fins 6-rayed, below or slightly in front of dorsal; anal fin much shorter than dorsal; pectorals rather narrow, rounded, placed low, with 12 to 15 rays, which are much articulated; caudal rounded. Preopercle and preorbital with mucous pores. Branchiostegals 6. Gill rakers short, thick. Size small. Three species, very similar to each other, inhabiting the waters of the United States and Austria. (Latin, *umbra*, a shade.)

MELANURA (μέλας, black; οὐρά, tail):

- *a.* Base of caudal with a dark bar; American species.
    - *b.* Body with pale crossbars; coloration dull olive green, with about 14 narrow, pale, transverse stripes; dark bar at base of caudal often faint; lower jaw pale. LIMI, 919.
    - *bb.* Body with lengthwise streaks; coloration dark olive green, with about 12 pale narrow lengthwise streaks, the one at upper angle of opercle twice width of the others; dark caudal bar very distinct; lower jaw black. PYGMÆA, 920.

### Subgenus MELANURA, Agassiz.

### 919. UMBRA LIMI (Kirtland).

(MUD MINNOW; DOGFISH.)

Head 3¾; depth 4¼. B. 6; P. 14; D. 14; A. 8; V. 6; scales 35–15. Body oblong, compressed. Coloration dull olive green, mottled with darker and with about 14 narrow, pale, transverse bars, often obscure in the young; dark bar at base of caudal distinct but often faint; lower jaw pale; fins plain. Length 4 inches. Quebec to Minnesota and southward to the Ohio River; abundant northward, throughout the basin of the Great Lakes, in weedy streams and ditches; rare in tributaries of the Ohio and Illinois. "A locality which with the water perfectly clear will appear destitute of fish will perhaps yield a number of mudfish on stirring up the mud at the bottom and drawing a seine through it. Ditches in the prairies of Wisconsin, or mere bog holes, apparently affording lodgment to nothing beyond tadpoles, may thus be found filled with *Melanuras*." (Baird.) (*limus*, mud.)

*Hydrargyra limi*, Kirtland, Bost. Journ. Nat. Hist., III, 1840, 277, streams in northern Ohio. (Coll. Kirtland.)

*Hydrargyra fusca*, Thompson, Hist. Vermont, 137, 1842, Lake Champlain.

*Hydrargira atricauda*, De Kay, New York Fauna: Fishes, 220, 1842, Lake Champlain.

*Umbra limi*, Günther, Cat., VI, 232, 1866; Jordan & Gilbert, Synopsis, 350, 1883; Blatchley, Proc. Ac. Nat. Sci. Phila., 1885, 12.

### 920. UMBRA PYGMÆA (De Kay).

(Eastern Mud Minnow.)

Head 4; depth 4½. D. 13; A. 7; scales 35. Body less compressed than in *Umbra limi*, the head broader, less depressed, with smaller eye; interorbital space slightly more convex; snout shorter, the profile more gibbous. Color dark greenish, with about 12 narrow, longitudinal pale stripes, the one beginning at upper angle of opercle double the width of any of the others; dark bar at base of caudal very distinct, covering 1½ scales; lower jaw mostly black. Length 4 inches. Lowland streams and swamps coastwise, from Long Island to the Neuse River; locally abundant. Close to the preceding and perhaps a variety of it, but no intermediate forms have been noticed. (*pygmæus*, pigmy.)

*Leuciscus pygmæus*, De Kay, New York Fauna: Fishes, 214, 1842, Tappan, Rockland Co., N.Y.

*Fundulus fuscus*, Ayres, Bost. Journ. Nat. Hist., IV, 1843, 296, Brookhaven, Long Island.

*Melanura annulata*, Agassiz, Amer. Journ. Sci. Arts, 1854, 135; not *Exoglossum annulatum*, Rafinesque.

*Umbra pygmæa*, Jordan, Bull. U. S. Nat. Mus., X, 53, 1877.

*Umbra limi pygmæa*, Blatchley, Proc. Ac. Nat. Sci. Phila., 1885, 13.

## Family XCI. LUCIIDÆ.

(The Pikes.)

Body elongate, not elevated, more or less compressed posteriorly, broad anteriorly. Head long, the snout prolonged and depressed. Mouth very large, its cleft forming about half the length of the head; lower jaw the longer; upper jaw not protractile, most of its margin formed by the maxillaries, which are quite long and provided with a supplemental bone; premaxillaries, vomer, and palatines with broad bands of strong cardiform teeth which are more or less movable; lower jaw with strong teeth of different sizes; tongue with a band of small teeth. Head naked above; cheeks and opercles more or less scaly; gill openings very wide; gill membranes separate, free from the isthmus; gill rakers tubercle-like, toothed; branchiostegals 12 to 20. Scales small; lateral line weak, obsolete in young specimens, developed in the adult. Dorsal posterior, opposite and similar to anal; caudal fin emarginate; pectoral fins small, inserted low; ventrals rather posterior; vent normal; no adipose fin; no barbels; stomach not cœcal, without pyloric appendages; pseudobranchiæ glandular, hidden; air bladder simple. Basis cranii double (Cope.) Fishes of moderate or large size, inhabiting the fresh waters of the northern parts of Europe, Asia, and North America. A single genus with 6 species, one of them cosmopolitan, the rest all confined to America. The species are all noted for their greediness and voracity; "mere machines for the assimilation of other organisms." The flesh is excellent, being white and flaky and of delicate flavor. The larger species are much valued as food. (*Esocidæ*, Günther, Cat., VI, 226–230, 1866.)

## 299. LUCIUS,* Rafinesque.

### (PIKES.)

*Esox*, ARTEDI, Genera Piscium, 14, 1738, (in part, three species: The Pike, Garfish, and Gar Pike; no type indicated, but the Pike was to ARTEDI the best-known species).

*Esox*, LINNÆUS, Syst. Nat., Ed. x, 1758, 314, (in part, *lucius*, *belone*, *osseus*); (restricted by RAFINESQUE, 1810, to *Esox belone*).

*Lucius*, RAFINESQUE, Caratteri di Alcuni Nuovi Generi, 59, 1810, (*lucius*).

*Picorellus*, † RAFINESQUE, Ich. Oh., 70, 1820, (*vittatus*, a mythical species).

*Mascalongus*, JORDAN, Klippart's Report, Ohio Fish Comm., 92, 1878, (*nobilior*).

*Kenoza*, JORDAN & EVERMANN, new subgenus, (*americanus*).

Characters of the genus included above. (*Lucius*, the Latin name of the Pike.)

- a. Cheeks entirely scaly; branchiostegals 11 to 16.

**KENOZA** (an Indian name of the Pike, variously spelled by authors):

- b. Opercles entirely scaly; dorsal rays 11 to 14; color greenish, barred or reticulated with darker.
  - c. Branchiostegals normally 12, (11 to 13); scales in lateral line 105 to 108; dorsal rays 11 or 12; anal rays 11 or 12; snout short, the middle of eye nearer tip of lower jaw than posterior margin of opercle. Species of small size, the fins unspotted.

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[*] In retaining the generic name *Lucius* for the Pike, in preference to *Esox*, we have followed the strict law of priority. The genus *Esox* of Linnæus, composed primarily of *E. lucius* and *E. belone*, with a few associated species, was first subdivided by Rafinesque in 1810, the second species, *Belone*, being chosen as the type. Later, in Cuvier's arrangement, *lucius* was left as the type of *Esox* and a new name, *Belone*, given to *Esox belone*. This later arrangement has received the sanction of general usage. It has the further justification, that the name *Esox* itself was adopted by Artedi and Linnæus, from Pliny, who applied it to the Pike, its application to the Garfish also having been taken by Linnæus from Artedi. It is true that Linnæus would have regarded the Pike as his type of *Esox*. It is, however, also true that Rafinesque had the right to select either species as the type in dividing the genus, and in his arrangement, the Garfish remains *Esox*, and a new name, *Lucius*, is given to the Pike.

Rafinesque says: "Il genere *Esox* di Linneo è stato diviso da Lacépède in quattro generi, *Esox*, *Sphyræna*, *Synodus* e *Lepisosteus*, id propongo di dividere nuovamente in due il suo genere *Esox*. Lascierò questo nombre alle specie marine che hanno il corpo tetragono con due linee laterali da ogni lato como nel genere *Exocœtus*, le mascelle lunghe e strette, le ale dorsali lunghe, giungendo dall' ano fino alla coda e falciformi, etc. Mentre formerò un nuovo genere col nome di *Lucius* delle specie fluviatili che hanno il corpo cilindrico, una sola linea laterale, le mascelle larghe e le ale dorsali ed anali corte e rotondate."

[†] The name *Picorellus*, Rafinesque, can not properly be retained for any section of this genus, as *Esox vittatus*, Rafinesque, on which it is based, is a mythical species described by Rafinesque from a rude drawing, perhaps based on hearsay, and certainly not representing any known species.

*d.* Head short, $3\frac{4}{7}$ in length of body; snout $2\frac{1}{2}$ in length of head; eye $2\frac{2}{3}$ in length of snout. Color dark green; sides with about 20 distinct curved blackish bars; fins plain. AMERICANUS, 921.

*dd.* Head longer, $3\frac{1}{4}$ in length of body; snout $2\frac{1}{5}$ in length of head; eye $2\frac{1}{2}$ in length of snout. Color light greenish, the sides with many narrow curved streaks of darker; these usually distinct, irregular, and much reticulated; fins plain. VERMICULATUS, 922.

*cc.* Branchiostegals 14 to 16; dorsal rays 14; anal 13; scales in lateral line about 125; middle of eye midway between tip of lower jaw and posterior margin of opercle; head about $3\frac{1}{3}$ in length of body; snout $2\frac{1}{3}$ in head; eye $3\frac{1}{2}$ in snout. Color greenish, with many narrow dark curved lines and streaks, mostly horizontal and more or less reticulated; fins plain. RETICULATUS, 923.

LUCIUS:

*bb.* Opercles with the lower half bare of scales; branchiostegals 14 to 16; dorsal rays 16 or 17; anal rays 13 or 14; scales in lateral line about 123; head $3\frac{1}{4}$ in length of body; snout $2\frac{2}{5}$ in length of head; eye 3 in snout; middle of eye midway between tip of lower jaw and gill opening. Color grayish, with many whitish spots, the young with whitish or yellowish crossbars; dorsal, anal, and caudal spotted with black; a white horizontal band bounding naked portion of opercle. Size large. LUCIUS, 924.

MASCALONGUS (*masca*, mask; *longus*, long):*

*aa.* Cheeks as well as opercles with the lower half naked; branchiostegals 17 to 19; dorsal rays 17; anal rays 15; scales in lateral line about 150; middle of eye midway between tip of lower jaw and gill opening; head $3\frac{2}{3}$ in length of body; snout $2\frac{1}{3}$ in head; eye more than 4 times in length of snout. Color dark gray, the sides usually with scattered round black spots, sometimes immaculate, sometimes banded with dark; fins spotted with black; size very large. MASQUINONGY, 925.

### Subgenus KENOZA, Jordan & Evermann.

### 921. LUCIUS AMERICANUS (Gmelin).

(BANDED PICKEREL.)

Head $3\frac{3}{5}$; depth $5\frac{1}{2}$; eye 5. B. 12 or 13; D. 11 or 12; A. 11 or 12; scales 105. Body short and robust; head heavy, with blunt, short snout; eye rather large, its diameter $2\frac{2}{3}$ in length of snout, its posterior margin scarcely behind middle of head, its middle nearer tip of chin than gill opening; snout $2\frac{1}{2}$ in head. Cheeks and opercles fully scaled; upper branchiostegals scaly. Dark green; sides with about twenty distinct, blackish, curved bars, sometimes obscurely marked, but not distinctly reticulated; a black bar below eye, another from upper edge of opercle through eye to snout; fins plain. Length 12 inches. A small pickerel, abundant from Massachusetts to Florida, in lowland streams and swamps. Found only east of the Alleghany Mountains, the westernmost record being from Escambia River, at Flomaton, Alabama.

*Esox lucius β americanus*, GMELIN, Systema Naturæ, 1390, 1788, Long Island, New York; after SCHÖPF.

*Esox niger*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., I, 1818, 415, South Carolina; GÜNTHER, Cat., VI, 229, 1866.

*Esox scomberius*, MITCHILL, Amer. Month. Mag., 1818, 322, Murderer's Creek, New York.

*Esox fasciatus*, DE KAY, New York Fauna: Fishes, 224, 1842, Murderer's Creek and other streams near New York.

*Esox ornatus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 41, Charles River, Massachusetts.

*Esox raveneli*, HOLBROOK, Ichth. South Carolina, 201, 1860, Charleston, South Carolina.

*Esox americanus*, JORDAN & GILBERT, Synopsis, 352, 1883.

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* An erroneous etymology of the word muscalonge, formerly supposed to be from the French *Masque'allongée*, long face. The word is now known to be of Indian origin, *Mas-Kinongé*. *Kinongé* is apparently the same word as *Kenoza*.

### 922. LUCIUS VERMICULATUS (Le Sueur).

(LITTLE PICKEREL.)

Head 3¼; depth 5 to 6; eye large, 2½ in snout, about 6 in head. B. 12 (11 to 13); D. 11 or 12; A. 11 or 12; scales 105. Body moderately stout, somewhat compressed; head rather short, longer than in *Lucius americanus*, but shorter than in *L. reticulatus*, the eye being exactly in the middle of the head; middle of eye nearer tip of chin than gill opening; snout 2⅕ in head; caudal well forked. Color green or grayish; sides with many curved streaks, sometimes forming bars, but more usually forming marmorations or reticulations, the color extremely variable, sometimes quite plain; sides of head usually variegated; a dark bar downward from eye, and one forward; base of caudal sometimes mottled; other fins usually plain. Length 12 inches. Mississippi Valley, tributaries of Lake Erie and Lake Michigan south to Mississippi and Arkansas; not known from east of the Alleghanies nor Texas; a small species, very abundant in the small streams and bayous of the South and West. (*vermiculatus*, with marks like worm tracks.)

*Esox vermiculatus*, LE SUEUR, in CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVIII, 333, 1846, Wabash River, New Harmony, Indiana; (Coll. Le Sueur); MEEK & NEWLAND, Proc. Ac. Nat. Sci. Phila., 1885, 369.

*Esox lineatus*, LE SUEUR, in CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVIII, 335, 1846, Wabash River, New Harmony, Indiana. (Coll. Le Sueur.)

*Esox crassus*, AGASSIZ, Amer. Journ. Sci. Arts, 1854, 308, Tennessee River, Huntsville, Alabama.

*Esox umbrosus*, KIRTLAND, Proc. Cleveland Ac. Sci., 1854, 79, small bay of Rocky River, Rockport, near Cleveland, Ohio; COPE, Trans. Amer. Philos. Soc. Phila., 1866, 409.

*Esox cypho*,* COPE, Proc. Ac. Nat. Sci. Phila., 1865, 78, Waterford, Oakland County, Michigan; (Coll. Professor Miles); GÜNTHER, Cat., VI, 230, 1866.

*Esox porosus*, COPE, Trans. Amer. Philos. Soc. Phila., 1866, 408, Waterford, Oakland County, Michigan; substitute for *cypho*, regarded as an inept name. (Coll. Professor Miles.)

*Esox salmoneus*, JORDAN & GILBERT, Synopsis, 352, 1883; not of RAFINESQUE.

### 923. LUCIUS RETICULATUS,† (Le Sueur).

(COMMON EASTERN PICKEREL; GREEN PIKE; JACK.)

Head 3½; depth 6; eye small, about 3½ in snout, 8 in head. B. 14 to 16; D. 14; A. 13 (counting developed rays only); scales 125. Body rather slender, deepest near the middle and tapering backward to a slender caudal peduncle; head long, the snout prolonged, about 2½ times in head. Middle of eye midway between tip of chin and gill opening. Cheeks and opercles entirely scaly; caudal well forked. Color green, of varying shades; sides with golden luster, and marked with numerous dark lines and streaks, which are mostly horizontal, and by their junction with one another produce a reticulated appearance; a dark band below eye; fins plain. Length 24 inches. Maine to Florida and Louisiana, Arkansas, and Tennessee; common everywhere east and south of the Alleghany Mountains; abundant in the New York lakes. The southernmost record is from Crooked Lake, Orange County, Florida, (Lönnberg). The westernmost is from Mammoth Springs, Arkansas, and other tributaries of White River, it being common in the Ozark region. (Meek; Call.) We know no characters by which the Southern Pike (*phaleratus* = *affinis*) can be separated from *Lucius reticulatus*. (*reticulatus*, netted.)

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* This form (*cypho* = *porosus*), distinguished mainly by the arched back and steep profile, is probably a variety or accidental form of *vermiculatus*.

† "A solemn, stately, ruminant fish, lurking under the shadow of a lily pad at noon, with still, circumspect, voracious eye, motionless as a jewel set in water, or moving slowly to take up its position; dashing from time to time at such unlucky fish or frog or insect as comes within its range and swallowing it at a gulp. Sometimes a striped snake, bound for greener meadows across the stream, ends its undulatory progress in the same receptacle."—*Thoreau.*

*Esox reticulatus*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., I, 1818, 414, Connecticut River, Adams, Mass.; Philadelphia; GÜNTHER, Cat., VI, 229, 1866; JORDAN & GILBERT, Synopsis, 353, 1883.

*Esox phaleratus* (SAY) LE SUEUR, Journ. Ac. Nat. Sci. Phila., I, 1818, 416, St. Augustine, Florida.

*Esox tridecemlineatus*, MITCHILL, Mirror, 1825, 361, Oneida Lake, New York.

*Esox affinis*, HOLBROOK, Ichth. South Carolina, 198, 1860, Charleston, South Carolina.

### Subgenus LUCIUS.

### 924. LUCIUS LUCIUS (Linnæus).

(COMMON PIKE; PICKEREL.)

Head 3⅓; depth 5; eye 6⅓ in head, 3⅓ in snout; snout 2⅖ in head. B. 14 to 16; D. 16 or 17 (developed rays); A. 13 or 14 (developed rays); scales 123. Body moderately elongate, the back little elevated; head rather long, the eye exactly midway in its length; middle of eye midway between tip of chin and gill opening. Cheeks entirely scaly; lower half of opercles bare. General color bluish, or greenish gray, with many whitish or yellowish spots, which are usually smaller than the eye and arranged somewhat in rows; dorsal, anal, and caudal fins with roundish or oblong black spots; young with the whitish spots coalescing, forming oblique crossbars; a white horizontal band bounding the naked part of the operculum, each scale with a grayish V-shaped speck. Length 4 feet. Fresh waters of the northern parts of Europe, Asia, and North America, north to Alaska and Siberia; in the Eastern United States south to New York and the Ohio River; in Europe, south to Italy and Greece; everywhere very abundant. We do not find any permanent character by which the American Pike (*estor*) can be separated from the common *lucius* of Europe.

*Esox lucius*, LINNÆUS, Syst. Nat., Ed. X, 1758, 314, Europe; GÜNTHER, Cat., VI, 226, 1866; JORDAN & GILBERT, Synopsis, 353, 1883.

*Luccius vorax*, RAFINESQUE, Indice d'Ittiol. Sicil., 68, 1810, Palermo.

*Esox estor*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., I, 1818, 413, Lake Erie, at Buffalo; DE KAY, N. Y. Fauna: Fishes, 222, 1842; GÜNTHER, Cat., VI, 228, 1866.

?? *Esox vittatus*,* RAFINESQUE, Amer. Monthly Mag., III, 1818, 447, Ohio River.

*Esox australis*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVII, 323, 1846, locality unknown; thought to be Van Diemen's Land.

*Esox deprandus*, LE SUEUR, in CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVII, 336, 1846, Wabash River, New Harmony, Indiana; (Coll. Le Sueur); GÜNTHER, Cat., VI, 229, 1866.

*Esox lugubrosus*, LE SUEUR, in CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVII, 338, 1846, Crab Orchard, Kentucky. (Coll. Le Sueur.)

*Esox boreus*, AGASSIZ, Lake Superior, 317, 1850, Lake Superior. (Coll. Agassiz.)

*Esox lucioides*, AGASSIZ & GIRARD, in Herbert Forrester's Fish and Fishing, 154, 1850, Lake Superior.

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*Described from hearsay. It may have been intended for this species or for the Muskallunge. The drawing of the species shown in the original MS. notebook of Rafinesque shows that this is a mythical species.

### Subgenus MASCALONGUS, Jordan.

### 925. LUCIUS MASQUINONGY (Mitchill).

(Muskallunge; Maskinongy; Muscalonge; Great Pike.)

Head 3⅔; depth 6; snout 2⅔ in head; eye 4 to 6 in snout. B. 17 to 19; D. 17; A. 15; scales 150. General form of the common pike, the head a little larger proportionally. Cheeks naked below, as the opercles are; scaly part of cheeks variable, usually about as wide as eye; the scales on both cheeks and opercles in about 8 rows; middle of eye midway between tip of lower jaw and posterior margin of opercle. Color dark gray; sides in the typical form, with round or squarish blackish spots of varying size on a ground color of grayish silvery; these sometimes obsolete (*immaculatus*), sometimes coalescing in bands (*ohiensis*); belly white; fins spotted with black. Length 4 to 8 feet. A magnificent fish, by far the largest of its family, reaching a weight of 100 pounds or more; found in the Great Lake region, Upper Mississippi, and northward; also occasionally taken in Ohio River, frequent in Chautauqua Lake, Conneaut Lake, and other clear lakes outside the Great Lake system. The typical form, var. *masquinongy*, known by the black spots, is confined to the Great Lakes, their outlets, and tributaries. "A long, slim, strong, and swift fish, in every way fitted to the life it leads, that of a dauntless marauder." (Hallock.) (*Maskinongé*, or *Mas Kenosha*,* or *Mask-Kinongé*, a name variously spelled, applied by the Ojibway Indians to the lake pike and muskallunge.)

*Esox masquinongy*, Mitchill, "Mirror,† 297, 1824," Lake Erie. Specimen 47 inches long and weighing 30 pounds. D. 21; A. 17, including rudiments; Meek & Newland, Proc. Ac. Nat. Sci. Phila., 1885, 372.

*Esox masquinongy* (Mitchill) Kirtland, Fishes of Ohio, 194, 1838, Lake Erie.

*Esox nobilior*, Thompson, Proc. Bost. Soc. Nat. Hist., iii, 1850, 163, Lake Champlain; Jordan, Bull. U. S. Nat. Mus., x, 54, 1877, and of most late writers; Jordan & Gilbert, Synopsis, 353, 1883.

*Esox nobilis*, Kirtland, Proc. Cleveland Ac. Sci., 1854, 84, Lake Erie; name a slip of the pen for *Esox nobilior*.

*Esox atromaculata*, "Kirtland MS." Kirtland, *l. c.*, 1854, 84, under synonymy of *Esox nobilis*.

Represented in the Ohio River and its tributaries by

### 925a. LUCIUS MASQUINONGY OHIENSIS (Kirtland).

Body with narrow, dark cross shades, which break up into vaguely outlined dark spots. Specimens of muskallunge from Chautauqua Lake show narrow, dark crossbars, which split up into diffuse spots; fins with black spots. These seem to be allied to the typical form *masquinongy* rather than to var. *immaculatus*, but are somewhat different from either in coloration. No constant difference in other respects is apparent. The name *Esox salmoneus*, "White with many narrow transversal brown bands, somewhat curved; length 5 feet," seems to belong to this form. The name *salmoneus*, however, is not eligible, being preoccupied.

*Esox salmoneus*, Rafinesque, Amer. Monthly Mag., iii, 1818, 447, Ohio River; not *Esox salmoneus*, Mitchill, 1815, which is *Synodus fœtens*.

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*See Mather, Forest & Stream, March 18, 1886. According to Mr. H. W. Henshaw, *mask* is ugly; *kinongé*, fish, in the Ojibway dialects.

†This reference is given on the authority of De Kay. We have carefully searched the files of the Mirror and do not find this description. The name *masquinongy* will, in any case, however, hold from the account given by Kirtland.

*Esox ohiensis*,[*] KIRTLAND, Proc. Cleveland Academy Nat. Science, February 7, 1854, 85, Mahoning River.

Represented in the head waters of the Mississippi and its tributaries by

### 925b. LUCIUS MASQUINONGY IMMACULATUS[†] (Garrard).

(GREAT NORTHERN PIKE.)

Body unspotted, or with vague, dark cross shades; tail a little more slender and fins a little higher than in the spotted or lake muskallunge. Lakes and rivers of Wisconsin and Minnesota, locally abundant. (*immaculatus*, unspotted.)

*Esox immaculatus*, GARRARD MS.; noticed in different fishing journals; Eagle Lake, northern Wisconsin.
*Esox masquinongy immaculatus*, JORDAN, Man. Vert., Ed. 5, 89, 1888.

## Family XCII. PŒCILIIDÆ.[‡]

(THE KILLIFISHES.)

Body oblong or moderately elongate, compressed behind, depressed forward, covered with rather large cycloid scales, which are adherent and regularly arranged. Lateral line wanting or represented by a few imperfect pores. Head scaly, at least above. Mouth terminal, small, the lower jaw usually projecting; margin of the upper jaw formed by the premaxillaries only; premaxillaries strong, extremely protractile. Teeth incisor-like or villiform, sometimes present on the vomer, but usually in the jaws only; lower pharyngeals separate, with cardiform or rarely molar teeth; third upper pharyngeal enlarged, the fourth wanting or united to the third. Gill membranes somewhat connected, free from isthmus; gill rakers very short, thick. Branchiostegals 4 to 6. Pseudobranchiæ none. Dorsal fin single, inserted posteriorly, of soft rays only, rarely with a single spine or a rudimentary spinous dorsal; caudal fin not forked; ventral fins abdominal, rarely wanting; pectoral fins inserted low; no adipose fin. Stomach siphonal, without pyloric appendages. Air bladder simple, often wanting. Basis cranii simple (*fide* Cope). Sexes usually unlike, the fins being largest in the males, but in some species the females are much larger in size. Many of the species are ovoviviparous, the young well developed at time of birth. In these species the sexes are very unlike, the anal fin of the male being developed as an intromittent organ. Fresh-water fishes of Southern Europe, Asia, Africa, and America, some of them occurring in bays and arms of the sea. They are mostly of small size, and the species are very difficult of determination. Genera 30; species about 180. (*Pœciliidæ*, Bonaparte Nuovi Ann. Sci, Nat., II, 132, 1838.)

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[*] We are indebted to Mr. Barton A. Bean for the following copy of Kirtland's description:

"IV. *Esox ohiensis*, KIRTLAND: From a very perfect stucco cast and a dessicated head of a specimen taken in the Mahoning, a tributary of the Ohio River, it is evident that this species is distinct from any of the preceding. Its contour is more regular, oval, and elliptical than that of the *E. estor* and less regular than that of the *E. nobilis*. The head is rather small, fusiform and attenuated, and its vertical measurement through the eye proportionately less than in any other species. Caudal fin emarginate and falcate more acutely than the *Estor*. The color of the back greenish brown; sides lighter, but shaded with brown; underneath white. Total length 30 inches; head 7½; vertical line through the eye, from frontal surface to bottom of lower jaw 2⅜ inches. This species sometimes attains 31¼ pounds weight."

[†] "This is the fish that has just claims to the name of The Great Northern Pike, as there is abundant and unquestionable testimony of enormous size, ranging from 40, 75, 80, and 110 pounds. The habitat of this fish is the waters of the Mississippi system, and it has been well known since the earliest settlement of the West under various local names, as Chautauqua Lake Pike, Alleghany River Pike, Muskingum River Pike, Kentucky River Pike, Rock River (Illinois) Pike, and is now found in the greatest abundance and of the largest size, in the clear, cold lakes of the Wisconsin and Minnesota pineries, at the heads of the tributaries of the Mississippi. In early days, before the streams were rendered turbid by the washing of lands in cultivation, this fish was more abundant in Lake Pepin than it now is, but a few are taken occasionally. One of 75 pounds was taken in those early days by reputable citizens still living at Lake City. One of 40 pounds was taken two years ago by a man who fishes for the market, and numbers have been taken ranging from 2 pounds to 20 pounds. This fish is generally found either in these pinery streams or near the mouth of them in the Mississippi River." (General Israel Garrard, in a letter dated June 1, 1886, Frontenac, Minnesota.)

[‡] Concerning the name to be given to this family Dr. Gill remarks:

"In my 'Families and Subfamilies of Fishes' (1893, No. 133) I have adopted *Pœciliidæ* instead of *Cyprinodontidæ* for the family at present generally known by the latter name.

"It is quite true that Professor Agassiz was the first to recognize the family so called, but he simply gave the plural form of *Cyprinodontes*, and not a name with the patronymic suffix now almost universally used to denote families, and he did not define it, but simply gave it to the residuum left after defining the *Cyprini*. Little later Bonaparte gave a regular family name (*Pœciliidæ*) derived from the earliest established name of a genus of the family and that name was several times employed by him and others while the name *Cyprinodontes* remained in abeyance; he also regularly defined it. The first regular use of the latter name with a patronymic suffix (*Cyprinodontidæ*) was by Sir John Richardson in 1856.

"Another objection to the name *Cyprinodontidæ* which may reconcile us to its abandonment is that it expresses a taxonomic falsehood and is even now constantly misleading persons. In the part of the great 'New English Dictionary,' lately published (v. 2, p. 1306), a '*Cyprinodont*' is defined as 'a malacopterygious fish of the family *Cyprinodontidæ*, of which the typical genus is *Cyprinodon*; they differ from the Cyprinids in having the jaws more projecting and toothed.' In the recent Manual of Moreau (1892, p. 479), the '*Cyprinodontides*' and '*Cyprinides*' are approximated in an analytical table and simply contrasted on account of the presence of jaw teeth ('mâchoires dentées') in the former and the absence (mâchoires 'non dentées') in the latter. It certainly is time for trained ichthyologists to have learned that there is no affinity between the two types, and that they differ so radically in all essential features of organization that they should be referred to different orders. Yet Valenciennes, in the penultimate volume of his great work (Hist. Nat. Poiss., XXI, p. 455), attempted to justify the retention of the Cyprinodonts in the same *family* with the Cyprinids and their natural allies. The Cyprinodonts or Pœciliids are really related to the Esocids and Umbrids, and to them they should be approximated in the suborder *Haplomi*." (Gill, Proc. U. S. Nat. Mus., 1894, 115.)

We begin the discussion of this group with the largest genus, which seems at the same time to be the most primitive and the least specialized.

*a.* Intestinal canal comparatively short, little convoluted; teeth little movable; bones of the dentary firmly connected; the lower jaw strong and usually projecting beyond upper; species chiefly carnivorous.
  *b.* Anal fin of the male similar to that of the female and not modified into an intromittent organ. Species oviparous.
    *c.* Teeth all pointed, none of them compressed or bicuspid or tricuspid.
    FUNDULINÆ:
      *d.* Ventral fins well developed; pharyngeal bones and teeth not enlarged.
        *e.* Teeth in villiform bands or at least in more than one series.
          *f.* Air bladder well developed (in all species examined); no caudal ocellus.
            *g.* Gill openings not restricted above, the opercular angle free from shoulder girdle; body oblong; dorsal various in size and insertion. FUNDULUS, 300.
            *gg.* Gill openings restricted, the opercle from upper root of pectoral upward being adnate to shoulder girdle; body short and deep. ADINIA, 301.
          *ff.* Air bladder wanting; a black ocellus at root of caudal—at least in males. RIVULUS, 302.
        *ee.* Teeth arranged in a single series; dorsal inserted in advance of anal; mouth oblique.
          *j.* Dorsal and anal fins short, each of 9 to 13 rays. LUCANIA, 303.
          *jj.* Dorsal and anal fins very long, each of more than 20 rays. GIRARDINICHTHYS, 304.
    ORESTIINÆ:
      *dd.* Ventral fins wanting; body oblong.
        *i.* Pharyngeal bones both above and below greatly enlarged, bearing coarse molar teeth; scales normal, regularly imbricated, none of them ridged. EMPETRICHTHYS, 305.
  CYPRINODONTINÆ:
    *cc.* Teeth incisor-like, notched, bicuspid or tricuspid.
      *j.* Ventral fins well developed (occasionally lost through atrophy); gill openings restricted; the opercle adnate above to the shoulder girdle.

*k.* Incisors bicuspid, with a band of villiform teeth behind them; body rather deep, the vertical fins moderately developed. Characodon, 306.

*kk.* Incisors tricuspid, in 1 row, with no villiform teeth behind them; body short and deep, compressed.

*l.* Dorsal fin short, of 10 to 12 rays, the first ray slender and rudimentary. Cyprinodon, 307.

*ll.* Dorsal fin very long, of 16 to 18 rays, the first ray developed as a stout, grooved spine. Jordanella, 308.

*bb.* Anal fin in the males placed well forward and modified into a sword-shaped intromittent organ; teeth all pointed, arranged in bands. Species viviparous, the young of large size at birth.

Gambusiinæ:

*m.* Eye normal, the pupil not divided by a partition; dorsal inserted more or less behind front of anal.

*n.* Jaws not produced into a beak, lower jaw prominent, longer than upper; male fish very much smaller than the female.

*o.* Dorsal fin long, of 14 to 16 rays; anal short. Pseudoxiphophorus, 309.

*oo.* Dorsal fin short, of 6 to 10 rays; anal short. Gambusia, 310.

*nn.* Jaws produced into a moderate beak, much as in *Labidesthes*; dorsal and anal short. Belonesox, 311.

Anablepinæ:

*mm.* Eye divided into 2 portions by a horizontal cross partition; vertical fins short; body elongate. Anableps, 312.

*aa.* Intestinal canal elongate, with numerous convolutions; dentary bones loosely joined; teeth movable; species chiefly mud-eating.

Goodeinæ:

*p.* Teeth incisor-like, all tricuspid, in 1 series, with a series of villiform teeth behind them; sexual characters unknown, the sexes probably alike; lower jaw projecting.

*q.* Fins small; scales large; form oblong. Goodea, 313.

Pœciliinæ:

*pp.* Teeth all pointed; anal fin in the male advanced and modified into an intromittent organ; lower jaw short and weak. Species ovoviviparous.

*r.* Teeth in a single series; dorsal and anal both short; scales large.

*s.* Dorsal fin inserted in advance of anal. Platypœcilus, 314.

*ss.* Dorsal fin inserted more or less behind front of anal. Heterandria, 315.

*rr.* Teeth in more than one series.

*t.* Dorsal inserted more or less behind anal; both fins very small. Lebistes, 316.

*tt.* Dorsal inserted over or in advance of anal, its rays much elevated in the male.

*u.* Dorsal fin short, of less than 7 to 11 rays.

*v.* Teeth of inner series in both jaws trifid. Acropœcilia, 317.

*vv.* Teeth of inner series in both jaws entire. Pœcilia, 318.

*uu.* Dorsal fin long, of 12 to 16 rays.

*w.* Caudal fin normal, alike in both sexes, or with the lower angle merely sharp in the male. Mollienisia, 319.

*ww.* Caudal fin in the males with its lower lobe much produced and sword-shaped, in the adult as long as rest of body. Xiphophorus, 320.

## 300. FUNDULUS, Lacépède.

(Killifishes.)

*Fundulus*, Lacépède, Hist. Nat. Poiss., v, 37, 1803, (*mudfish*).
*Hydrargira*, Lacépède, Hist. Nat. Poiss., v, 378, 1803, (*swampina*).
? *Aplocheilus*,[*] McClelland, Ind. Cypr. As. Res., xix, 301, 1839, (*chrysostigmus* = *panchax*).

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[*] We question the reference of *Aplocheilus* and *Panchax* to *Fundulus*, because the East Indian species, *Aplocheilus panchax*, the type of both nominal genera, has a long, depressed snout, and a physiognomy unlike the American species. According to Günther, its vomerine teeth are minute and rudimental. There are no vomerine teeth in the species of *Fundulus*.

? *Panchax*, Cuvier & Valenciennes, Hist. Nat. Poiss., XVIII, 380, 1846, (*panchax*).
*Zygonectes*, Agassiz, Amer. Journ. Sci. Arts, 1854, 135, (*olivacea* = *notatus*).
*Apocheilichthys*, Bleeker, Mem. Soc. Harlem, 1863, 116, (*typus*).
*Micristius*, Gill, Canadian Naturalist, August, 1865, (*cingulatus*).
? *Haplochilus*, Günther, Cat., VI, 310, 1866, (corrected spelling).
*Xenisma*, Jordan, Bull. Buffalo Soc. Nat. Hist., 1876, 142, (*stellifera*).
*Borborys*,* Broussonet MS., Goode & Bean, Proc. U. S. Nat. Mus., 1885, 204, (*heteroclitus*).
*Fontinus*, Jordan & Evermann, new subgenus, (*seminolis*).
*Gambusinus*, Jordan & Evermann, new subgenus, (*rathbuni*).

Body rather elongate, little elevated, compressed behind. Mouth moderate, the lower jaw projecting. Jaws each with two or more series of pointed teeth, usually forming a narrow band. Bones of the mandible firmly united. Scales moderate. Gill opening not restricted above, the opercle with its margin not adnate to shoulder girdle. Preopercle, preorbital, and mandible with mucous pores. Dorsal and anal fins similar, small, or rather large, the dorsal inserted either in front of, above, or behind, the front of anal; ventrals well developed. Air bladder present. Sexes differing in color, size, and development of the fins, the anal fin in the male normal. Intestinal canal short. First superior pharyngeal without teeth; second with teeth; third and fourth co-ossified, with teeth. Species very numerous, mostly American,† inhabiting fresh waters and arms of the sea. They are the largest in size of the Cyprinodonts, and some of them are very brightly colored. They are oviparous and feed chiefly on animals. Some of them are bottom fishes, burying themselves in the mud of estuaries; others swim freely in river channels and bays; still others are "top minnows," surface swimmers, feeding on floating insects in swamps and streams. We here unite the nominal genus *Zygonectes* to *Fundulus*, as there is a perfect gradation of the species from those with long dorsal fin to those in which the dorsal fin is small and posterior. The extremes of the two groups are, however, very different, the distinctions being greater than usually occur within the limits of a natural genus. (*fundus*, bottom, the abode of the "*Fundulus mudfish*.)

I. Species with the dorsal fin moderate or rather large, of 11 to 17 rays, its insertion above or usually in front of the insertion of the first ray of the anal; scales large or small. Free-swimming species, not feeding at the surface, some of them often burying themselves in the mud of bottoms in shallow water.
  *a.* Dorsal fin inserted before origin of anal; branchiostegals 5 or 6.
    Fundulus:
      *b.* Scales large, 31 to 38 in a lengthwise series.

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* Goode & Bean, who have examined the type of *Cobitis heteroclitus*, Linnæus, observe.
"No. 11, Garden, 'Anonymos,' see page 305, vol. I, Smith's Correspondence of Linné. The editor of this volume has evidently been misled by the common name 'mudfish' in referring No. 11 to *Amia calva*, which was No. 4 of a later lot. (See page 312.)

"The above example was apparently the type of Linné's description of *Cobitis heteroclitus*. In the annotated copy of edition XII, Linné wrote that it was referred to a new genus, '*Borborys*,' of Broussonet, with the following characters: 'Corpus squamosum. Pinn. dorsi unica. Maxill. infer. intr. carin. Caput squamosum.' We have not been able to ascertain whether or not Broussonet has published a description of this genus.
"The skin is 122 mm. long. The head is ¼ of the total length without caudal, and the depth about the same. D. 12; A. 10. Scales in 33 longitudinal and 12 transverse rows. A black blotch is still apparent on the posterior part of the dorsal." (Goode & Bean, Proc. U. S. Nat. Mus., 1885, 204.)

† The few European species referred to *Fundulus* seem allied to the subgenus *Xenisma*. The Asiatic and African forms are allied to or belong to the group *Zygonectes*. In some of them the anal fin is much larger than in the American species.

*c.* Scales in lateral line 31 to 34, 10 to 12 in a cross series; body rather elongate, the depth 4 to 4½ in length; dorsal rays usually 12.

*d.* Body without cross bands; each scale above and especially posteriorly, with a vertical purplish spot in the center; dorsal with series of blackish dots; anal rays 13. PUNCTATUS, 926.

*dd.* Body with cross bands light or dark, probably in both sexes; anal rays 9 to 11.

*e.* Body with about 23 narrow, undulating, silvery bars, narrower than the dark interspaces; fins nearly plain; head large, 3¾ in body. VINCTUS, 927.

*ee.* Body in both sexes with 10 to 15 narrow, dark, vertical bars; anal fin small.

*f.* Snout shortish, shorter than eye; a black spot on back before dorsal; head bluntish, 3½ in length. PALLIDUS, 928.

*ff.* Snout very long, 1½ times length of eye in adult; no black spot before dorsal; male with an ocellated dorsal spot; head pointed and elongate, 3⅓ in body; branchiostegals 6. SIMILIS, 929.

*cc.* Scales in lateral line 35 to 38.

*g.* Anal rays 10 to 12.

*h.* Dorsal rays 11 or 12; depth of body 3¾ to 4.

*i.* Female with two or three black horizontal stripes; male with about 12 dark crossbars and a dorsal ocellus; head long, 3¾ in length; branchiostegals 6. MAJALIS, 930.

*ii.* Female plain or with dark cross bands only; no black horizontal stripes.

*j.* Branchiostegals 6; coloration dull greenish, nearly plain, the male with about 20 short, blackish crossbars, the female with an obscure dark lateral shade; no dorsal ocellus. D. 13; A. 11. PARVIPINNIS, 931.

*jj.* Branchiostegals 5.

*k.* Dorsal rays 10 or 11.

*l.* Color greenish, both sexes usually with dusky or silvery crossbars and pearly spots, at least on the fins of the male; dorsal sometimes with an ocellus; scales 35 or 36.

*m.* Form robust, the depth 3⅔ in length; the head 3⅔; dorsal ocellus faint or wanting; males with many pearly spots; females nearly plain. HETEROCLITUS, 932.

*mm.* Form rather slender, the depth 4 in length; the head 3¼; dorsal ocellus on female very conspicuous; pearly spots fewer; female banded or spotted. OCELLARIS, 933.

*ll.* Color greenish, in spirits without bands or spots; body deep; tail slender; fins small. FONTICOLA, 934.

*kk.* Dorsal rays 12 to 14; olivaceous, with about 15 dark cross bands. BERMUDÆ, 935.

*gg.* Anal rays 16 or 17; dorsal rays 13 or 14; upper lip thick; scales 38–15 or 16.

*n.* Form robust, the depth in adult about 3 in length; color uniform pale brown, the fins unspotted. ROBUSTUS, 936.

*nn.* Form rather slender, the depth 4½ in length; color uniform brown, or slightly mottled on tail; fins unspotted, the anal of male black at base, yellow distally. LABIALIS, 937.

FONTINUS (*fons*, fountain):

*bb.* Scales comparatively small, 44 to 60 in lateral line; dorsal fin of 13 to 15 rays; anal rays 11 to 14.

*o.* Scales moderate, in a longitudinal series, 44 to 48.

*p.* Anal rays 11; depth 4 to 5 in length.

*q.* Body stout, compressed, the depth 4 in length; 15 scales in a cross-series; olivaceous, with many silvery crossbars. ADINIA, 938.

*qq.* Body rather slender, the depth 4⅔ to 5 in length; 12 scales in a cross-series; color olivaceous, with numerous crossbars, either black or silvery. DIAPHANUS, 939.

*pp.* Anal rays 13; body elongate, the depth 5⅔ in length; olivaceous, with very faint dark crossbars. EXTENSUS, 940.

*oo.* Scales very small, about 60–21.

*r.* Dorsal rays 14 or 15; anal 13 or 14; color olivaceous, sides with many dark crossbars; depth 4½ in length. ZEBRINUS, 941.

*rr.* Dorsal fin very long, of 17 rays; anal rays 13; scales small, about 52 in longitudinal series; depth about 4; olivaceous, many scales usually with a dark spot, these forming longitudinal streaks; sometimes faint dark crossbands. SEMINOLIS, 942.

*aa.* Dorsal fin inserted over or slightly behind front of anal fin; branchiostegals 4 or 5; bright colored species with orange or brown spots, inhabiting mountain springs and brooks.

XENISMA (*ξένισμα*, a surprise):

*s.* Scales small, 50 to 53 in lateral line; dorsal and anal large, of 13 to 15 rays each.

*t.* Orange spots on sides in regular series, replaced in the female by brown horizontal dashes; branchiostegals 5; D. 14; A. 15; depth 4¾ in length. CATENATUS, 943.

*tt.* Orange spots on sides irregularly scattered; branchiostegals 4; D. 13; A. 13; depth 5 in length. STELLIFER, 944.

GAMBUSINUS (Spanish *Gambusino*, a fish not worth bringing home. See *Gambusia*):

*ss.* Transitional species. Scales large, 36 to 42 in lateral line; dorsal and anal small, each of 10 or 11 rays; small species, intermediate between *Xenisma* or *Fundulus* and *Zygonectes*, the dorsal fin small, but not distinctly behind anal.

*u.* Anal rays 14; scales 36. Color brownish, finely dotted; lips, top of head, and line along middle of back dark; tail with faint cross-streaks; depth 4¼ in length. LINEATUS, 945.

*uu.* Anal rays 9 to 11.

*v.* Scales 38 to 42; body without black crossbars.

*w.* Scales 38; olivaceous, with horizontal oblong brownish spots scattered over back and sides; depth 4½ in length. RATHBUNI, 946.

*ww.* Scales 42; rows of scales with whitish streaks in males, or narrow black lines in females, forming lines along the rows of scales; depth 4¼ in length. ALBOLINEATUS, 947.

*vv.* Scales about 45; body with about 14 irregular dark crossbars; rows of scales of upper parts with longitudinal lines. D. 10; A. 10; depth 3¾ in length. CONFLUENTUS, 948.

*vvv.* Scales about 35, 24 before dorsal; body with about 15 well-marked black crossbands, as in *Fundulus similis* or *F. cingulatus*, between which this species seems to find its place; fins plain. D. 9 or 10; A. 9. FUNDULOIDES, 949.

II. ZYGONECTES (*ξυγόν*, yoke; *νέκτης*, swimmer, the species being said to swim at the surface in pairs). Species with the dorsal fin small, of 7 to 11 rays, its insertion distinctly behind front of anal fin; small species with large scales (29 to 40); surface swimmers, "Top minnows," seeking insects at the surface of water.

*a.* Anal fin long, of 14 to 25 rays; vomer sometimes with minute teeth.

*b.* Anal rays 14; dorsal rays 8; scales 31–8; depth 5 in length; olive, the body plain; dorsal and anal with dark crossbands; base of caudal with round pale spots. DOVII, 950.

*aa.* Anal rays 8 to 13.

*c.* General coloration olivaceous, either plain or with pearly or orange spots paler than the ground color, or blackish spots not forming distinct series; no sharply defined black crossbars or longitudinal black stripes.

*d.* Anal rays 12 or 13; body slender, the depth 4 to 5 in length.

*e.* Scales 35–12; dorsal 11 or 12; ventrals very small; coloration plain, the fins reddish. MACDONALDI, 951.

*ee.* Scales 31–10; dorsal rays 10; scales bordered with orange; fins yellow, edged with crimson. FLORIPINNIS, 952.

*eee.* Scales 33–10; dorsal rays 8 or 9; body with fine specks which are clustered together on sides, forming irregular, scattered, round, blackish spots. JENKINSI, 953.

*dd.* Anal rays 8 to 11.

*f.* Scales rather large, about 33 to 35–10; depth about 4 in length; anal rays 8 to 11; head 3¼ to 3½ in length.

*g.* Dorsal rays 10 or 11; back and sides dusted with fine dark points which are gathered together forming 10 or 12 scattered, round, brown spots on sides; fins with minute specks. PULVEREUS, 954.

*gg.* Dorsal rays 7 to 9.

*h.* Dorsal fin inserted over sixth ray of anal; anal rays 11; body (in female) nearly plain olivaceous; fins plain or with a few black dots. ARLINGTONIUS, 955.

*hh.* Dorsal inserted over first to third ray of anal (in the male).

*i.* Body with many bronze or orange spots, arranged along the rows of scales either regularly or irregularly; females dull greenish; young with greenish cross shades.

*j.* Anal rays 10 or 11; teeth of outer series in upper jaw comparatively long and slender, longer than the other teeth; orange spots rather large and irregular in position. HENSHALLI, 956.

*jj.* Anal rays 8 or 9; teeth in outer series scarcely enlarged, scarcely larger than others in the band; spots regularly placed, somewhat as in *Fundulus catenatus*. RUBRIFRONS, 957.

*ii.* Body with rather large pearly white spots scattered over the scales; fins plain. SCARTES, 958.

*ff.* Scales rather small, 39–13; body deep, the depth 3½ in length; dorsal and anal each with 10 or 11 rays; coloration nearly plain. SCIADICUS, 959.

*cc.* General coloration olivaceous, marked by distinct black crossbars, but without distinct black longitudinal band or rows of black streaks; dorsal fin much smaller than anal and inserted behind it, its rays 8 to 10.

*k.* Male with a large jet-black ocellus on the dorsal fin; anal rays 10; dorsal 8; scales 35–11; depth 4⅓ in length; sides in both sexes with 10 to 12 black bars. LUCIÆ, 960.

*kk.* Male and female without black ocellus on the dorsal; scales 32 to 36.

*l.* Anal rather long, its rays 11; vertical fins dotted with brown; pearly spots sometimes present; depth 3⅘ in length; scales 32–12. CHRYSOTUS, 961.

*ll.* Anal moderate, its rays 8 or 9; scales 34 to 36–10.

*m.* Dark cross bands 15 or 16. Body rather stout, the depth about 4 in length; interspaces on sides orange, with many dark points; fins red. CINGULATUS, 962.

*mm.* Dark cross bands about 12. Body slender, the depth about 4½ in length; dorsal and anal with streaks of dark dots. (male of) NOTTII, 963.

*ccc.* General coloration olivaceous, but crossed by many dark lengthwise streaks, each formed of many black spots arranged in parallel lines along the rows of scales; sides often with black crossbars also, especially in the male (in which the lengthwise streaks are sometimes obsolete); a black area below eye. Scales 35 to 40.

*n.* Body rather slender, the depth 4½ to 5 in length.

*o.* Black spots on scales in the female confluent into about 6 narrow jet-black, rope-like stripes from head to tail, these sometimes alternating with fainter lines of dots; cheeks bright orange in life, silvery in spirits. Males with the streaks obscure, the dark cross bands more distinct, about 12 in number. Scales 36 to 40. NOTTII, 963.

*oo.* Black spots on scales distinct, not confluent into lines, the whole forming longitudinal series of disconnected dots; cheeks orange. Scales 36. GUTTATUS, 964.

*ooo.* Black spots very small, sprinkled over upper surface, passing backward into longitudinal streaks. HIEROGLYPHICUS, 965.

*nn.* Body deep, the depth 3½ in length; female with the black spots coalescent into about 10 wavy streaks along sides; male with the lines of dots more or less interrupted; scales 35. DISPAR, 966.

*cccc.* General coloration olivaceous, with a single black lateral stripe from head to tail.

*p.* Body slender, the depth 4½ in length; lateral stripe broad, purplish, its edges wavy; back and vertical fins speckled. D. 9; A. 11. Scales 34–10. NOTATUS, 967.

*pp.* Body stout, the depth 3⅓ in length; sides silvery, with black lateral shade above the silvery part. D. 11; A. 11. Scales 31–10. MELAPLEURUS, 968.

### Subgenus FUNDULUS, Günther.

### 926. FUNDULUS PUNCTATUS, Günther.

Head 4; depth 4½. D. 12; A. 13; V. 6; scales 34–12. Interorbital space very broad, slightly convex, its width half head. Snout broad, obtuse, much depressed, the lower jaw scarcely projecting beyond the upper; mandible longer than eye. Upper lip of moderate breadth, not extending to angle of mouth. Eye less than length of snout, 4½ in head, and less than half interorbital width. Origin of dorsal somewhat nearer to extremity of caudal than orbit, over nineteenth scale of lateral series; first anal ray opposite to third of dorsal; dorsal and anal fins subquadrangular, with the outer margins convex, each a little longer than high; caudal fin subtruncate, scaly on its basal half; pectoral fins shorter than head (without snout), not extending to base of ventrals. Brownish olive, paler below; each scale, especially those on the tail, with a vertical dark purplish violet spot on the center; dorsal with 3 or 4 series of blackish dots, anal with a whitish margin. Length 3½ inches, (male). Chiapas. (Günther); not seen by us. (*punctatus*, dotted.)

*Fundulus punctatus*, GÜNTHER, Cat., VI, 320, 1866, Chiapam, Guatemala. (Coll. Salvin.)

### 927. FUNDULUS VINCTUS, Jordan & Gilbert.

Head 3¾; depth 4⅓; eye 3¼. D. 12; A. 11; scales about 31–10. Body little elongate, compressed posteriorly. Head large, very broad, and somewhat depressed above. Mouth moderate. Teeth in narrow bands, the outer much enlarged. Interorbital space 2. Scales comparatively large. Dorsal inserted moderately in advance of anal, its front midway between base of caudal and occiput, the fin of moderate height; pectoral 1⅔ in head; caudal 1⅕. Coloration, in spirits, olivaceous, with about 23 narrow silvery bars with undulating edges, the bars narrower than the darker interspaces; fins all plain in type. Length 2½ inches. This species is apparently related to *F. heteroclitus* and other Atlantic species. It may be distinguished from most of its relatives by its comparatively large scales. Coast of Lower California; known only from the original types collected near Cape San Lucas by John Xantus. (*vinctus*, banded.)

*Fundulus vinctus*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 355, Cape San Lucas.* (Type, No. 30973. Coll. Xantus.)

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* According to Mr. Lyman Belding a large part of the collection of John Xantus from "Cape San Lucas" was obtained in the pools and lagoons about La Paz. It is not unlikely that these shoal-water species come from the latter locality.

### 928. FUNDULUS PALLIDUS, Evermann.

Head 3½; depth 4; eye 3½. D. 12; A. 11; scales 31–11, about 16 before dorsal. Body stout; head heavy; caudal peduncle long and much compressed; snout short and blunt, shorter than eye, which is ⅔ the width of the interorbital space; humeral scale not enlarged, 2 rows of scales on the cheek; mouth rather small, little oblique, teeth pointed, in more than 1 series, the outer enlarged. Dorsal fin over the anal, its origin midway between base of caudal and posterior edge of opercle, or midway of total length, its rays short, about 1⅘ in head; anal rays about equal in length to those of dorsal. Scales medium, not firmly attached. Color pale yellowish; sides with about 13 narrow, dark, vertical bars, much narrower than the pale interspaces, not extending on the back or belly; scales sparsely covered with fine dark punctulations, few on the vertical fins and head; a large oblong black spot on the back immediately in front of dorsal fin. Allied to *Fundulus similis*, Baird & Girard, the head less pointed, the snout very much shorter, it being shorter than the eye, while in *Fundulus similis* it is 1½ times the eye; the dorsal has 1 more ray and the anal 2 or 3 more; the color paler, the bars less distinct, no dark dorsal line as in the other, while the pronounced black spot in front of the dorsal is not found on *Fundulus similis*. Galveston Bay, near Swan Lake, Texas; one specimen known. (*pallidus*, pale.)

*Fundulus pallidus*, EVERMANN, Bull. U. S. Fish Comm., XI, 1891 (May 25, 1892), 84, pl. 35, fig. 2, Galveston Bay, near Swan Lake, Galveston, Texas. (Type, No. 45564. Coll. Evermann, Scovell & Gurley.)

### 929. FUNDULUS SIMILIS (Baird & Girard).
(SAC-À-LAIT.)

Head 3¼ in length; depth 3¾ to 4⅗; eye 5 to 5½. D. 11 to 13; A. 10; scales 33–11. Body slender, the outlines scarcely arched; adults much deeper than young; head narrow, very long, and regularly narrowed forward; preorbital as wide as eye, 4½ to 5 in head; eye small, 1½ to 1¾ in interorbital; mouth small, maxillary not nearly reaching vertical from anterior nostril; teeth very small, in broad villiform bands, the outer series not at all enlarged; interorbital width 3⅓ in head. Dorsal long and low, the height less than length of base in adult males, 1⅓ in length of base in females; in males the last rays are but little higher than some of those preceding, in females the last are the lowest; longest ray (in ♂) 2⅕ in head; origin of dorsal midway between middle of eye and tip of caudal; origin of anal under third dorsal ray, the fin much higher than dorsal, the longest ray 1⅓ in head; posterior margins of oviduct adnate along either side of third anal ray, covering ¼ length of first ray. Pectorals reaching origin of ventrals, 1⅗ to 1¾ length of head; ventrals not reaching vent, 2⅓ in head, their base midway between pectorals and origin of anal; caudal subtruncate, 1⅔ in head. Scales large, in regular series. Color: ♂, olivaceous, bronze below; lower parts of head strongly orange; sides with 10 to 15 narrow, dark bars, ⅓ to ⅔ as wide as the interspaces, and not very dark; a large, diffuse, dark humeral blotch, extending from above opercle to about base of pectoral; each scale with a distinct >-shaped intermarginal series of dots, forming conspicuous reticulations; dorsal dusky, with black specks, mostly black at base; a small ocellated black spot behind, disappearing in adults; caudal faintly clouded with dusky, especially about the middle; ventrals pale, somewhat soiled. ♀, olivaceous, sides paler olive, with metallic luster; belly white; 7 to 15 very narrow, sharply defined black bars on sides, not extending on the back, scarcely broader than the pupil; scales marked as in the males, but much more faintly; fins pale, almost immaculate. Length 6 inches. Coast of the Gulf States, in brackish waters and shallow bays; very abundant from Florida to Texas. (*similis*, similar, the sexes being nearly alike.)

*Hydrargyra similis*, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1853, 389, Indianola, Texas; (Coll. Clark); GIRARD, U. S. & Mex. Bound. Surv., Zoöl., 68, pl. 35, figs. 1-8, 1859.

*Fundulus similis*, GÜNTHER, Cat., VI, 323, 1866; JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 252; JORDAN & GILBERT, Synopsis, 333, 1883.

### 930. FUNDULUS MAJALIS (Walbaum).

(KILLIFISH; MAYFISH; ROCKFISH.)

Head 3¾; depth 4. D. 12; A. 10; scales 36–13. Body oblong, scarcely elevated, little compressed; head rather prolonged anteriorly; the mouth small, terminal, and very oblique; scales rather large; dorsal fin moderate; anal fin very high in the males, moderate in the females; ventrals long in the males, reaching past front of anal; eye moderate, shorter than snout and than interorbital space; a slight angle formed by the profile, in front of the eye, due to the greater flattening of the snout. Males dark olivaceous above; sides silvery or somewhat golden, with about a dozen broad transverse bars of the color of the back; posterior part of the dorsal fin with a black patch; fins yellowish or pale. Females olivaceous above, white below, a narrow black longitudinal stripe along sides about on the level of the eye and as wide as the pupil; below this, two similar black stripes anteriorly and one posteriorly, the upper one being interrupted; one or two black bars at base of caudal. Females usually larger than the males. A large male of this species, in high coloration, taken at Beaufort, N. C., showed the following colors in life: Back olive, sides and belly bright salmon yellow; lower fins clear yellow; pectorals and anal with some dusky; posterior edge of caudal dark; dorsal nearly all black, a large black ocellated spot on the last rays; opercles and underparts of head with an inky suffusion; cheeks, top of head, and mouth bronze yellow; sides with about 18 narrow, dusky vertical bars. Teeth in a broad band; an outer row of rather large teeth. Oviduct adnate to first anal ray for a short distance. Length 6 inches. Cape Cod to Florida; the largest of our *Pœciliidæ*; abundant in shallow bays, especially northward. (*majalis*, pertaining to May, translation of Mayfish.)

*Mayfish*, SCHÖPF, Naturforscheren de Freunde, 1788, 172, Long Island.

*Cobitis majalis*, WALBAUM, Artedi Pisc., III, 12, 1792, Long Island; after *Mayfish* of SCHÖPF.

*Esox flavulus*, MITCHILL, Trans. Lit. & Phil. Soc. N. Y., I, 1815, 439, New York.

*Esox zonatus*, MITCHILL, Trans. Lit. & Phil. Soc. N. Y., I, 1815, 440, New York; young.

*Hydrargyra trifasciata*, STORER, Journ. Bost. Soc. Nat. Hist., I, 1837, 417, Massachusetts.

*Hydrargyra vernalis*, CUVIER & VALENCIENNES, Hist. Hat. Poiss., XVIII, 206, 1846, presented by M. LECONTE, probably from South Carolina.

*Hydrargyra majalis*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVIII, 207, 1846.

*Fundulus majalis*, GÜNTHER, Cat., VI, 322, 1866; JORDAN & GILBERT, Synopsis, 331, 1883.

### 931. FUNDULUS PARVIPINNIS, Girard.

Head 3½; depth 3⅔. D. 13; A. 11; scales 38–12. Body moderately elongate. Fins very high in the male, small in the female. Scales large; in the males in spring roughened or ctenoid by small granulations and prickles, similar to the nuptial excrescences of some *Cyprinidæ*; fins also rough. Oviduct forming a sheath at base of first ray of anal. Male light olive green, mottled with darker; sides with silvery and brassy luster; lower parts yellow; about 20 short blackish crossbars along middle of sides, broader, plainer, and more closely set behind; sides and fins with dark points; upper fins dull olive; lower yellow. Female larger, olive green above, sides not barred, with an obscure dusky lateral band on caudal peduncle; fins plain. Length 4 inches. Coast of California from Point Concepcion southward to Cerros Island; very abundant in bays and lagoons, especially about San Diego. (*parvus*, small; *pinna*, fin.)

*Fundulus parvipinnis*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 154, San Diego, California; GIRARD, Pac. R. R. Surv., x, 303, 1858; GÜNTHER, Cat., vi, 319, 1866; STEINDACHNER, Ichth. Beiträge, v, 155, 1876; JORDAN & GILBERT, Synopsis, 333, 1883.

### 932. FUNDULUS HETEROCLITUS (Linnæus).

(COMMON KILLIFISH; MUDFISH; COBBLER; MUD DABBLER; MUMMICHOG.)

Head 3 to 3⅔; depth 3⅗ to 3⅚. D. 11; A. 10 or 11; scales 35 to 38–13 to 15. Body thick-set, short, and deep; anteriorly broad, posteriorly compressed, the back elevated; the caudal peduncle robust; head rather short, blunt, broad and flat on top; eye moderate, about equal to snout, about half the width of interorbital space and ⅕ length of head; fins moderate, the dorsal inserted in males midway between snout and tip of caudal; in females farther back; oviduct attached to anterior ray of anal fin for ½ to ⅔ its length; teeth in moderate bands, pointed, the outer series enlarged; lower jaw strong, projecting beyond upper. Coloration in males dark dull green, the belly more or less orange yellow; sides with numerous quite narrow, ill-defined silvery bars made up of silvery spots, most distinct posteriorly; besides these are numerous conspicuous white or yellow spots, irregularly scattered; vertical fins dark, with numerous small round pale spots; dorsal often with a blackish spot on its last ray; anal and ventrals yellow anteriorly; under side of head yellow; young males with alternate bars of dark and silvery, the former becoming in time the ground color, the dorsal ocellus more distinct. Females nearly plain olivaceous, lighter below, without spots or bars, the scales finely punctate; sides often with about 15 dark crossbars or shades. Young, especially young females, with more or less distinct dark cross bands; these always present in the very young, in females narrower than the interspaces, in males much broader and less numerous. Length 3 to 6 inches. Coast of Maine to the Rio Grande, everywhere very common in brackish waters, often burying itself in the mud in shallow lagoons; the most abundant of our *Pœciliidæ*, varying considerably in size, coloration, and height of fins.* (ἑτερύκλίτος, irregular or unusual.)

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* In the adult male of the typical *heteroclitus* from Charleston, South Carolina, the longest dorsal ray is 1⅗ times in head (1⅘ in *macrolepidotus*; 2 in *grandis*); the longest anal ray 1⅕ (in *macrolepidotus* 1½; in *grandis* 1⅘); caudal 3½ in length (in *grandis* 4); ventrals reaching front of anal, 2 in head (in *grandis* barely to vent, 2⅗ in head); base of dorsal 2 in head (in *grandis* 2⅗).

*Cobitis heteroclita*, LINNÆUS, Syst. Nat., Ed. XII, 500, 1766, Charleston, South Carolina; after the Mudfish of DR. GARDEN.
*Pœcilia cœnicola*, BLOCH & SCHNEIDER, Syst. Ichth., 452, 1801, Carolina; after LINNÆUS.
*Fundulus mudfish*, LACÉPÈDE, Hist. Nat. Poiss., v, 37, 1803, Carolina; after LINNÆUS.
*Hydrargira swampina*, LACÉPÈDE, Hist. Nat. Poiss., v, 378, 1803, South Carolina.
*Fundulus heteroclitus*, GÜNTHER, Cat., VI, 318, 1866; JORDAN & GILBERT, Synopsis, 336, 1883; and of authors generally.

Represented northward, Maine to Virginia, by the dwarfish form

### 932a. FUNDULUS HETEROCLITUS MACROLEPIDOTUS (Walbaum).

(COMMON COBBLER; KILLIFISH.)

Smaller in size than the typical *heteroclitus* (from South Carolina); the fins lower, scarcely higher than in var. *grandis*. Longest dorsal ray 1⅘ in head; A. 1½. Scales on top of head rather smaller, body more slender and coloration generally paler; females nearly plain, the young females with dark bands. Maine to Virginia; everywhere very common in brackish waters, apparently passing gradually into the typical *heteroclitus*, from which it is scarcely to be separated even as a slight variety. (*μακρολεπιδωτός*, large-scaled.)

*Pœcilia macrolepidota*, WALBAUM, Artedi Piscium, III, 11, 1792, Long Island; after Yellow-bellied Cobbler of SCHÖPF, Naturf. Freunde., VIII, 171, 1788.
*Cobitis killifish*, WALBAUM, Artedi Piscium, III, 11, 1792, Long Island; after Killifish of SCHÖPF, Naturf. Freunde, VIII, 172, 1788.
*Pœcilia fasciata*, BLOCH & SCHNEIDER, Syst. Ichth., 453, 1801; after Yellow-bellied Cobbler of SCHÖPF.
*Esox pisciculus*, MITCHILL, Trans. Lit. and Phil. Soc. N. Y., I, 1815, 440, New York.
*Esox pisculentus*, MITCHILL, Trans. Lit. and Phil. Soc. N. Y., I, 1815, 441, New York.
*Hydrargyra nigrofasciata*,[*] LE SUEUR, Journ. Ac. Nat. Sci. Phila., I, 1817, 133, Newport, Rhode Island.
*Fundulus viridescens*, DE KAY, N. Y. Fauna: Fishes, 217, 1842, New York.
*Fundulus zebra*, DE KAY, N. Y. Fauna: Fishes, 218, 1842, New York.
*Fundulus pisculentus*, STORER, Fishes Mass., 294, 1839; and of many American authors.
*Fundulus nigrofasciatus*, STORER, Fishes Mass., 295, 1839; GÜNTHER, Cat., VI, 323, 1866; JORDAN & GILBERT, Synopsis, 335, 1883.

Represented along the Gulf Coast by

### 932b. FUNDULUS HETEROCLITUS GRANDIS (Baird & Girard).

Size larger than in the typical *heteroclitus*, the coloration brighter, the pale spots on the dorsal in the male larger, the dorsal and anal fins lower. Longest ray of dorsal 2 in head in males, 2¼ in females; anal rays 1¾ in males, 2 to 2⅓ in females; tips of dorsal in males scarcely reaching halfway to base of caudal.

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[*] The nominal species *Fundulus nigrofasciatus*, of which we have numerous specimens from Woods Hole, Mass., seems to us the young female of *Fundulus heteroclitus macrolepidotus*. It is thus described by Dr. Günther:

*Fundulus nigrofasciatus* (Le Sueur): Head 3⅔; depth 4. D. 11; A. 9; scales 33–11. Body rather short and deep; head rather long and depressed; the snout obtuse, a slight angle being formed above the eye, dorsal moderate, well back; anal short and deep; eye longer than snout, 1½ in interorbital space; 3⅓ in head. Olivaceous above, silvery below; fins in both sexes immaculate; males with 9 or 10 very distinct silvery crossbars, each about as broad as a scale; females with about as many narrow black bars, which do not extend on the back or belly; scales punctate. Length 2½ inches. (Günther.) Atlantic coast of United States, recorded from Massachusetts and Rhode Island.

The following are the life colors of this form, taken from specimens from Pensacola: Males very dark green above, paler posteriorly; sides with many small, round, pearly white spots, some of them often in vertical series; posteriorly traces of 8 to 10 narrow, pale crossbars alternating with broader, faint dusky ones; belly yellowish; sides of head dusky; caudal greenish, dusky behind, its basal part with numerous small white spots; dorsal olive, anteriorly orange, with many small white spots; the white spots larger and less numerous than in the typical *heteroclitus*; anal and ventrals orange, speckled with white; pectorals light yellow. Female olive and silvery, with minute speckles below; sides usually with traces of 12 to 15 narrow, silvery vertical bars, not half so wide as the dusky interspaces; no white spots on body or fins; fins mostly dusky olive, nearly plain. Length 6 inches. (*grandis*, great.)

*Fundulus grandis*, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1853, 389, Indianola, Texas; GIRARD, U. S. Mex. Bound. Surv., Ichth., 69, pl. 36, 1859. (Coll. Jno. H. Clark.)
*Fundulus floridensis*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 157, Charlotte Bay, Florida.
*Fundulus heteroclitus grandis*, JORDAN & SWAIN, Proc. U. S. Nat. Mus., 1882, 230.

### 933. FUNDULUS OCELLARIS, Jordan & Gilbert.

Head 3 to 3⅓; depth 4; eye 4. D. 11; A. 10; V. 6; P. 13. Scales 35–15. Female with a large black ocellus on the dorsal fin. Head comparatively small and narrow, with short, depressed snout, and weak jaws; body rather slender; lower jaw little longer than upper; eye small, 1⅖ in interorbital width, equaling snout, which equals length of mandible; teeth all villiform, in narrow bands in each jaw, the outer series but little enlarged; preorbital narrow, less than half diameter of orbit. Dorsal fin (in ♂ 3 inches long) much elevated, reaching, when depressed, beyond base of rudimentary rays of caudal; much shorter than this in females and young males. Origin of dorsal midway between tip of caudal and tip of snout, or slightly nearer snout; the base of the fin 1½ in height of longest ray, which is contained 1¼ in head; outline of fin rhomboid, the upper edge straight, the last rays highest; anal fin similar to dorsal, but narrower and slightly lower, not reaching caudal when depressed; its origin under second ray of dorsal and distant from caudal half as far as from tip of snout; base half height of longest ray; greatest height of caudal peduncle ⅔ its length and half length of head; oviduct not attached to first anal ray, but forming a low sheath along base of first six rays; caudal short, rounded, 1¼ in head; pectorals slender, reaching base of ventrals, 1⅔ in head; ventrals (in adult ♂) extending beyond front of anal, half length of head. Scales moderate, in somewhat irregular oblique series, a few imperfect pores in lateral line; humeral scale not enlarged; 18 scales before dorsal. Female with somewhat deeper body, and different coloration; the fins smaller, the last ray of dorsal shorter than those preceding, and not reaching halfway from its base to rudimentary caudal rays; length of longest ray greater than base of fin; ventrals not nearly reaching vent; front of dorsal nearer tip of caudal than end of snout. Color ♂, dark olive brown above, golden on sides and below; scales margined with darker; sides with 13 to 15 dark cross bands of the color of the back, not extending on the belly, but almost reaching lower median line behind ventrals; these bands usually parallel, the anterior ones, at least, narrower than interspaces; sides posteriorly finely speckled with small pearly spots which cover both bands and interspaces; dorsal and anal margined with orange anteriorly; the two fins tinged with orange and checked with black and pearl color; caudal light orange, indistinctly barred at base with series of linear blotches; pectorals and ventrals plain orange, the former slightly dusky. ♀ dark above, sides finely dusted with dark points, pale below, tinged with yellowish; middle of sides with about 13 very narrow, short, dark half bars; back sometimes with small black blotches; dorsal dusky, with a very distinct black spot ocellated with white, on its posterior rays; caudal and anal plain dusky; ventrals light yellowish. Length 3 inches. Gulf Coast of Florida to Louisiana,* in bays and streams; not rare; apparently variable. (*ocellaris*, having an eye-like spot.)

?? *Fundulus limbatus*, Kröyer, Naturhist. Tidsskr. Kjöbenhaven, Vol. 2, 3d series, 1863, 94, footnote 1, New Orleans; merely a MS. name of Kröyer's for a specimen in the Royal Museum of Copenhagen.

*Fundulus ocellaris*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 255, Pensacola, Florida, in salt water; (Type, Nos. 29667 and 30853. Coll. Jordan); Woolman, Bull. U. S. Fish Comm., x, 1890, 300, pl. 52, fig. 2, (good figure).

### 934. FUNDULUS FONTICOLA, Cuvier & Valenciennes.

D. 11; A. 12; B. 5; scales 37. Body plump, with long caudal peduncle. Head broad, little depressed; the tail slenderer and the body deeper than in *Fundulus heteroclitus*; dorsal inserted in front of anal; dorsal and caudal small and rounded, the anal high and pointed, the paired fins short. Teeth in broad bands, the outer little enlarged. Uniform green, apparently without spot or band in spirits. (Color entirely lost in the original type.) Length 2 inches. Mountain springs in Porto Rico; here described from the original type, the only known example, as the other specimens possessed by Cuvier & Valenciennes belong to a species of *Gambusia*. (*fons*, fountain; *colo*, I inhabit.)

*Fundulus fonticola*, Cuvier & Valenciennes, Hist. Nat. Poiss., xviii, 198, 1846, Porto Rico; Jordan, Proc. U. S. Nat. Mus., 1886, 526, (examination of original type).

### 935. FUNDULUS BERMUDÆ, Günther.

(Mangrove Minnow.)

Head 3¾; depth 4. D. 14; A. 12; scales 35–13. Snout short, not longer than eye, the lower jaw projecting beyond it. Interorbital width 2⅓ in head; eye 4. Dorsal inserted before anal, midway between preopercle and root of caudal; anal much higher than long. Brownish olive, the male with faint dark green cross bands. Length 3 inches. Bermudas. (Günther.)

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* Specimens from New Orleans, in fresh water, differ in color. Males with about 15 sharply defined cross bands as broad as silvery interspaces; a few dark dots above; pearly dots on dorsal and anal, few or none on body. Females light olive, with many small dark spots forming obscure series; large spots as large as pupil scattered over the body; no trace of dark cross bands; dorsal with a conspicuous black ocellus on its last rays. Dorsal low and small, inserted a little before the small anal. Eye equal to snout, 4⅕ in head; interorbital with 2⅒. Head 3⅗; depth 3⅘. D. 10; A. 10. Scales 34–13. Length 2½ inches. This is possibly a species different from *F. ocellaris*.

*Fundulus bermudæ*, GÜNTHER, Ann. Mag. Nat. Hist., 1874, 4, reprint, Bermudas.
*Fundulas rhizophoræ*,* GOODE, Amer. Journ. Sci. Arts, 1877, 298, Basden Pond, Bermudas, in brackish water among the roots of the mangrove (*Rhizophora mangle*); locally abundant.

### 936. FUNDULUS ROBUSTUS, Bean.

Head 3¼; depth 3; eye 4½ to 5. B. 5; D. 14; A. 16; V. 6; P. 16; scales 38–16. Head broad, the distance between eyes equal to length of eye and snout. Top of head nearly flat; eye as long as snout. Mouth very obliquely placed, the lower jaw longer than upper. End of maxillary reaching to below front of eye; width of mouth ⅓ head. Teeth in jaws in narrow bands or biserial, the outer series somewhat enlarged. Gill rakers short, stout, about 19 on the first arch. Thirteen scales between upper angle of gill opening and origin of dorsal; dorsal commencing nearly midway between tip of snout and end of tail. Ventral origin midway between tip of snout and base of caudal; anal origin under middle of dorsal; in the female the first six rays are short and stiff, and the genital opening is immediately in front of, and disconnected from, the anal fin; in the male the middle caudal rays are ½ as long as head; slightly shorter in the female. Color uniform pale brown; fins unspotted, and the opercle with a golden tint. Length 5 inches. Streams of Guanajuato. (*robustus*, robust.)

*Fundulus robustus*, BEAN, Proc. U. S. Nat. Mus., 1892, 285, pl. 44, fig. 2, Guanajuato, Mexico. (Type, No, 43760. Coll. Dugès.)

### 937. FUNDULUS LABIALIS, Günther.

Head 4 to 4⅓; depth 4½; eye about 4. B. 6; D. 13 or 14; A. 16 or 17; V. 6; scales 37 to 39–15. Interorbital space broad, slightly convex, its width being less than half head. Snout broad, obtuse, depressed, with the jaws equal in front; mandible very short, not longer than eye; upper lip well developed, broad, extending to angle of mouth. Eye less than length of snout, and in females ½ of the width of the interorbital space, whilst in males the forehead is somewhat narrower. Origin of dorsal midway between extremity of caudal and orbit, over twentieth scale of lateral line; first anal ray opposite first of dorsal; dorsal fin as high as long in both sexes; anal fin rounded in the male, scarcely higher than long, much elevated in the female, the length of its base being ⅔ only of its depth. Genital opening of the female immediately in front of, but disconnected from, the anal fin. Basal third of the caudal fin (which is subtruncate) scaly. Body uniform brownish olive, paler below; sometimes irregular, cloudy markings on the tail; fins immaculate; the anal fin of the male black at the base and bright yellow on its marginal half; upper margin of the dorsal fin of the same sex yellowish. Length 4 inches. Rivers of Guatemala. (Günther.) (*labialis*, pertaining to the lip.)

*Fundulus labialis*, GÜNTHER, Cat., VI, 319, 1866, Rio San Geronimo, Guatemala, Yzabal. (Coll. Salvin & Godman.)

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* Dr. Goode's description of *Fundulus rhizophoræ* is more detailed than that of Dr. Günther. The only important difference shown is in the fin rays. Goode counts, D. 12; A. 11; scales 35–12 or 13. Color light tawny yellow, with about 15 regular tranverse bands of greenish brown, each 2 scales in width, most distinct posteriorly. Length 2½ inches.

### Subgenus FONTINUS, Jordan & Evermann.

### 938. FUNDULUS ADINIA, Jordan & Gilbert.

Head 3⅔; depth 4; eye 4. D. 13; A. 11; scales 44–15. Body short, deep, and compressed; head moderate, broad, and flat above, the interorbital space rather more than half greater than width of eye; dorsal and anal fins rather large; dorsal inserted almost exactly over front of anal; teeth mostly in two series, the outer very strong; vent midway between eye and base of caudal; scales small, closely imbricated. Color olivaceous, with 15 to 20 silver crossbars, almost as wide as the interspaces posteriorly, wider than the interspaces anteriorly, extending over the belly and joining their fellows on the opposite side; the bands variable, but usually wider and more crowded than in *F. diaphanus*; fins plain. Length 2 inches. Lower Rio Grande; only the types known, from Brownsville, Texas. (*Adinia*, a related genus.)

*Fundulus adinia*, JORDAN & GILBERT, Synopsis, 335, 1883, Rio Grande at Brownsville, Texas.

### 939. FUNDULUS DIAPHANUS (Le Sueur).

Head 4; depth 4⅘; eye large, 3½ in head. D. 13; A. 11; scales 45–15. Body rather slender, not elevated, compressed posteriorly. Head moderate; quite flat above. Teeth pointed, the outer not much enlarged. Fins not large; dorsal and anal rather low; ventrals scarcely reaching vent in the females; somewhat longer in the males. General color olivaceous; sides silvery. Male with about 20 silvery vertical bars, narrower than the dark interspaces; female with 15 to 20 dark transverse bars, shorter than the silvery bands of the male, the interspaces pale; back sometimes spotted; young always with black bars; fins nearly plain. Length 4 inches. Coast of Maine (W. C. Kendall) to Cape Hatteras, in river mouths, ascending streams to their fountain heads, hence abundant in lakes throughout New York; variety *menona* westward to northern Illinois; not found southward. The typical form found eastward and in the sea has the back nearly or quite unspotted. Examples from Grand Lake Stream and Boyden Lake, Maine, have the back somewhat spotted. In the Potomac River this is the most abundant species of the family. (*diaphanus*, *διαφανής*, transparent.)

*Hydrargyra diaphana*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., 1, 1817, 130, Saratoga Lake.

*Hydrargyra multifasciata*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., 1, 1817, 131, Saratoga Lake.

*Hydrargyra swampina*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVIII, 203, 1845, New Jersey; not of LACÉPÈDE.

*Fundulus multifasciatus*, GÜNTHER, Cat., VI, 324, 1866, and of many writers.

*Fundulus diaphanus*, JORDAN, Proc. Ac. Nat. Sci. Phila., 1877, 67; JORDAN & GILBERT, Synopsis, 334, 1883; HUGH M. SMITH, Bull. U. S. Fish Comm.,[*] X, 1890, 65.

*Fundulus swampina*, JORDAN & GILBERT, Synopsis, 332, 1883.

Specimens from west of New York belong to the well-marked

### 939a. FUNDULUS DIAPHANUS MENONA (Jordan & Copeland).

Head 3⅖; depth 5. D. 12; A. 10; B. 5; scales 48–12. Teeth pointed, curved, outer little enlarged. Dark bands very distinct, somewhat irregular in position, the back always spotted; the dark bands often replaced by about 16 shining, silvery, vertical bands, which are narrower than the dark interspaces; the interspaces broadest behind; fins plain. Length 3½ inches. Lakes and ponds from Ohio westward to the Mississippi River, not found much south of Chicago. (From Lake Menona, near Madison, Wisconsin.)

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[*] Specimens of the typical *diaphanus* have been examined by us from Cayuga Lake; New York Harbor; Coast of Maine; Shenandoah River; Potomac River; and Elizabeth River, Virginia.

*Fundulus menona*, JORDAN & COPELAND, Proc. Ac. Nat. Sci. Phila., 1877, 68, Catfish River, outlet of Lake Menona, Madison, Wisconsin; (Coll. Dr. Hoy); JORDAN & GILBERT, Synopsis, 335, 1883.

*Fundulus diaphanus menona*, JORDAN, Man. Vert., Ed. v, 85, 1888.

### 940. FUNDULUS EXTENSUS, Jordan & Gilbert.

Head 3¾; depth 5⅔; eye large, 3¼. D. 15; A. 13; scales about 47–12. Body unusually elongate, moderately compressed, the caudal peduncle long, much longer than head. Head slender, not very broad, the interorbital width 2⅖ in head. Mouth rather large; the teeth in a moderate band, the outer considerably enlarged. Dorsal fin rather long, of moderate height, its insertion well in front of that of anal, at a point midway between eye and base of caudal; pectoral small, 1⅔ in head; caudal 1⅖. Coloration, in spirits, plain, somewhat translucent, with no markings anywhere, except traces of some very narrow dark bars on the sides. Fins now plain. This species resembles somewhat *Fundulus diaphanus*, but it is more elongate. Coast of Lower California, know only from the original types. (*extensus*, drawn out.)

*Fundulus extensus*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 355, Cape San Lucas. (Type, No. 30972. Coll. Xantus.)

### 941. FUNDULUS ZEBRINUS, Jordan & Gilbert.

Head 3½ to 3¾; depth 4½ to 4¾; eye 4 to 4⅓; interorbital width 2⅔ in head; snout 3¾. Branchiostegals 5. D. 14 or 15; A. 13 or 14; scales 60–21. Head and body shaped much as in *Fundulus similis*, the snout less elongate. Width of preorbital 6½ in head; eye moderate, 1⅔ in interorbital width; posterior margin of orbit in middle of length of head; teeth in both jaws in villiform bands, with the external series much enlarged. Dorsal fin long and rather low, the base longer and the rays higher in males than in females; origin of dorsal nearly equidistant between snout and margin of caudal, slightly nearer the snout in males, and nearer end of caudal in females; base of dorsal in males 6 to 6½ in total length, the highest dorsal ray about half head; in females the base is 7½ in total length; origin of anal opposite that of dorsal in males, behind it in females; in the latter the anal is sharply angulated, the anterior rays more than thrice the height of the posterior, and more than ⅔ length of head. In males the margins of both dorsal and anal fins are evenly rounded, the anal the higher, its rays beset with minute white prickles. Oviduct forming a low sheath along base of anterior half of anal; pectorals not reaching base of ventrals, equaling distance from snout to preopercular margin; ventrals about reaching vent; caudal truncate, 1⅓ in head. Scales very small; no enlarged humeral scale. In males the margins of scales are rough, with minute tubercles. Greenish above, sides and below silvery white, the sides tinged with sulphur yellow; the greater part of each scale on back rendered dusky by black points; sides with 14 to 18 dusky bars from back to ventral region, occasionally meeting on ventral line; these bars are very variable in width, seemingly narrower in females, in which half bars are frequently inserted between the others; the interspaces are as wide as the bars, or usually wider. Fins yellowish, without distinct markings, in the males all very dusky except the anal. Length 3 inches. Kansas, western Iowa, and South Dakota, and south to Kentucky, Texas, and New Mexico; abundant in Font-qui-Bouille Creek at Pueblo, and in most clear tributaries of the upper Arkansas. (*zebrinus*, like a zebra.)

*Hydrargyra zebra*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 60, tributaries of Rio Grande, "between Fort Defiance and Fort Union, New Mexico;" name preoccupied by *Fundulus zebra*, DE KAY.

*Fundulus zebra*, GÜNTHER, Cat., VI, 324, 1866, not of DE KAY; JORDAN & GILBERT, Synopsis, 333, 1883.

*Fundulus zebrinus*, JORDAN & GILBERT, Synopsis, 891, 1883, (after GIRARD); GILBERT, Bull. Washburn Lab. Nat. Hist., 1, 1884, 15.

### 942. FUNDULUS SEMINOLIS, Girard.

Head $4\frac{1}{6}$ to $4\frac{1}{3}$; depth $5\frac{3}{4}$ to $6\frac{1}{3}$. D. 17; A. 13; eye 4; scales 52. Body slender, not compressed; back not elevated; caudal peduncle deep, depth the same as the height of dorsal, and also equal to the distance from the end of the snout to middle of pupil; head long and pointed, somewhat pyramidal; depth of body equal to distance from end of snout to hinder margin of preopercle; eye of medium size, $\frac{2}{3}$ the interorbital space. Teeth in two rows, those of the outer row in the lower jaw much enlarged; all pointed, movable, and curved inward. Dorsal fin longer than anal, the rays growing gradually shorter from the fifth to the last, giving the top of the fin a gentle convex curve; origin of dorsal above the termination of the ventrals; anal short, length of longest rays $1\frac{5}{6}$ that of base of fin, fourth ray longest, growing rapidly shorter to the last; posterior margin below posterior margin of the dorsal; ventrals small and short, not reaching vent; pectorals broad, barely reaching ventrals. Ground color olive green in the larger specimens, brighter in the males, or of a somewhat yellowish brown, caused by the scales having dark edges; male specimens usually with several longitudinal stripes formed of dark spots in the angles of the scales, making knots in the net which is formed by the dark borders of the scales; these spots larger on the back; these markings wanting in some specimens; all of the young, and the older females, crossed by 12 or 14 faint dark bars; fins often plain, but in developed males the dorsal and caudal have large dark spots arranged on bars; outer part of caudal mostly black in males; ventrals and anal orange, the outer edge black. Rivers and swamps of Florida; locally abundant. A handsome, sleek-looking species, well distinguished from all the others. (Named for the Seminole Indians, in whose domain it is found.)

*Fundulus seminolis*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 59, Palatka, Florida; GÜNTHER, Cat., VI, 325, 1866; JORDAN & GILBERT, Synopsis, 334, 1883; WOOLMAN, Bull. U. S. Fish Comm., X, 1890, 297, pl. 52, fig. 3, (good figure); LÖNNBERG, Öfvers. Kong. Vet. Akad. Förh., 116, 1894.

### Subgenus XENISMA, Jordan.

### 943. FUNDULUS CATENATUS (Storer).

(Studfish.)

Head 4; depth 4½ to 5. B. 5; D. 14; A. 15; scales 50. Similar in form to *Fundulus stellifer*, but larger, with lower fins and different coloration; dorsal and anal fins even in the males, falling short of the caudal; dorsal inserted above anal; anal prickly in spring males. Teeth in broad bands, the outer somewhat enlarged. Color bluish or greenish, with a round orange spot (in the male) on each scale, thus forming series of regular lines of dots; females with smaller brown spots on the scales, also forming lines. Length 6 or 7 inches. Tennessee and Cumberland rivers, and in clear streams of the Ozark Mountains; locally abundant; one of the largest and handsomest of the Cyprinodonts. (*catenatus*, chained.)

*Pœcilia catenata*, Storer, Synopsis Fish. N. A., 430 (178 of reprint), 1846, Tennessee River, Florence, Alabama; Günther, Cat., vi, 322, 1866.

*Fundulus catenatus*, Cope, Journ. Ac. Nat. Sci. Phila., 1868, 238; Jordan & Gilbert, Synopsis, 337, 1883.

*Xenisma catenata*, Jordan, Ann. Lyc. Nat. Hist. N. Y., 1876, 322.

### 944. FUNDULUS STELLIFER (Jordan).

(Studfish.)

Head 3¾; depth 5; eye 4. B. 4; D. 13; A. 13; V. 6; scales 53. Body rather long, somewhat compressed. Head broad and flattened above. Scales closely imbricated, deeper than long. Dorsal fin beginning slightly behind anal, its last rays in the adult males highly elevated, reaching the base of caudal, their height equal to the depth of the body; anal similar, more elevated in front and less so behind, the last rays falling just short of caudal; fins lower in females and young; pectorals reaching ventrals, the latter to anal in the males. Oviduct not extending on first anal ray. Teeth in a narrow band, the outer somewhat enlarged, blunt and curved. Coloration brilliant; livid blue above, somewhat silvery below; body and cheeks with large, bright, dark orange spots, irregularly placed, not following the rows of scales, and not always in the middle of the scales; these spots not uniform in size; females with olive brown spots horizontally, oblong and smaller than the orange spots of the males and more regularly placed; a blue loral blotch, with a green one below it; a pale yellow blotch on the back in front of the dorsal, very conspicuous when the fish is in the water. Length 4 inches. Alabama River and tributaries, in clear streams and springs; a most beautiful fish. (*stella*, star; *fero*, I bear.)

*Xenisma stellifera*, Jordan, Ann. Lyc. Nat. Hist. N. Y., 1876, 322, Etowah and Oostanaula rivers, Rome, Georgia. (Coll. Jordan.)

*Fundulus stellifer*, Jordan & Gilbert, Synopsis, 337, 1883.

### Subgenus GAMBUSINUS, Jordan & Evermann.

### 945. FUNDULUS LINEATUS* (Garman).

Head nearly 3; depth 4¼. D. 11; A. 14; V. 6; P. 15; scales 36–12. Body moderately stout, compressed. Crown flat. Eye large, as long as snout, 1¾ in interorbital width. Lower jaw slightly longer. Outer teeth long, slender, curved. First ray of dorsal almost opposite first of anal, ⅓ the distance from base of caudal to front of eye; caudal truncate. Brownish, finely punctate with brown; white below; lips, top of head, and a line along middle of back, dark; tail with faint transverse bands. Northeastern Wyoming. (Garman.) (*lineatus*, streaked.)

*Zygonectes lineatus*, GARMAN, Bull. Mus. Comp. Zoöl., VIII, No. 3, 88, 1881, northeastern Wyoming; JORDAN & GILBERT, Synopsis, 339, 1883.

### 946. FUNDULUS RATHBUNI, Jordan & Meek.

Head 3⅘; depth 4½; eye 3¾. D. 11; A. 11; scales 38–12. Body moderately elongate, rather robust, little compressed; the back broad, not elevated. Head moderately broad and depressed above; snout rather sharp, as long as eye; scales of medium size, the humeral scale not enlarged; 2 rows of scales on cheek. Fins all low and small; dorsal inserted posteriorly, its first ray opposite first of anal or slightly behind it; longest ray of dorsal 1¾ in head; anal larger than dorsal; pectoral short, 1½ in head; ventrals very short, reaching vent. Coloration in life pale green, with small, irregular, horizontally oblong dark brown spots scattered over head and body. Sexes not very different. Males with scales of body edged with black and with a pale lengthwise streak along upper part of each row of scales. Young with very obscure dark crossbars. Fins plain, yellowish in male, speckled at base only. Length 2½ inches. Eastern North Carolina; abundant in spring brooks, not descending to salt water; a pretty little fish, representing a transition from *Fundulus* to *Zygonectes*. (Named for Richard Rathbun, Chief of the Division of Scientific Inquiry of the United States Fish Commission.)

*Fundulus rathbuni*, JORDAN & MEEK, Proc. U. S. Nat. Mus., 1888, 356, Reedy Fork, Allemance Creek, Buffalo Creek, and other tributaries of the Cape Fear River, about Greensboro, North Carolina. (Type, No. 39860. Coll. Jordan, Jenkins & Meek.)

### 947. FUNDULUS ALBOLINEATUS, Gilbert.

Head 3⅓ to 3⅗; depth 4 to 4½; least depth of caudal peduncle equals snout and ⅔ eye. Scales 42; D. 10 or 11; A. 10 or 11; B. 5. Teeth sharp, wide set, in a broad band on premaxillaries, a narrow band on mandible. Snout ⅓ length of head. Width of interorbital space 2¼ to 2⅓ in head. Dorsal and anal opposite, or the dorsal slightly in advance, their bases equal and short, equaling length of snout and half eye; in males both fins become elevated, the longest anal ray equaling ⅔ head, and the anal rays become covered with prickles; in males the pectorals reach the ventrals, and the ventrals to or nearly to vent; both fins much shorter in females. Males blackish brown, the sides plumbeous, the rows of scales with interrupted whitish streaks, most conspicuous on hinder half of body; a black streak along middle line of back; vertical fins dusky, the caudal becoming translucent on distal half, its margin abruptly and narrowly black-edged. Females olivaceous, dusky on back, silvery below, the back and sides with narrow black lines following the rows of scales; fins translucent, the dorsal sometimes with fine black specks at base, the caudal black-edged. Length 3⅓ inches. Tennessee Basin in Alabama; not rare. (*albus*, white; *lineatus*, lined.)

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* This species and the four which follow seem to be entirely intermediate between the typical species of *Fundulus* and the species called *Zygonectes*. Their presence makes it apparently impossible to maintain *Zygonectes* as a distinct genus, notwithstanding the great difference between such species as *F. dispar* and *F. majalis*.

*Fundulus albolineatus*, Gilbert, Bull. U. S. Fish Comm., IX, 1889 (1891), pl. 43, fig. 1, 149, Spring Creek, Huntsville, Alabama. (Coll. Kirsch.)

### 948. FUNDULUS CONFLUENTUS, Goode & Bean.

Head 3½; depth 3⅘; eye 4 in head. D. 10; A. 10; V. 6; B. probably 5; scales 45. Head low, flat. Snout not produced, as long as eye. Interorbital space 2 in length of head. Origin of dorsal midway between tip of caudal and middle of eye; first ray of anal under second ray of dorsal; anal higher than long. Scales crowded. Yellowish gray, with a longitudinal streak along each row of scales and about 14 distinct irregular vertical dark bands. Appearance of *F. majalis*. Eastern Florida. One specimen known. (Goode & Bean.) (*confluentus*, flowing together.)

*Fundulus confluentus*, Goode & Bean, Proc. U. S. Nat. Mus., 1879, 118, Lake Monroe, Florida; (Type, No. 18065. Coll. Professor Baird); Jordan & Gilbert, Synopsis, 334, 1883.

### 949. FUNDULUS FUNDULOIDES (Evermann).

Head 3⅓; depth 4½; eye 3¼. D. 9 or 10; A. 9; scales 35–11, 24 before the dorsal. Body moderately robust, width at pectorals a little greater than greatest depth of head; snout rather blunt, equal to eye; interorbital width 1⅔ times diameter of eye; caudal peduncle deep and compressed; mouth not large nor greatly oblique; teeth pointed, the outer series being somewhat enlarged; peritoneum pale. General color in spirits, dark olivaceous; sides with 10 to 14 dark vertical bars, which are usually 2 to 3 times as wide as the intervening silvery ones; in one specimen the bars extending from the dorsal to the anal are about equal in width to the silvery interspaces; whole body, including all the fins, profusely dusted over with minute brownish spots, which are very numerous on back and top of head; a narrow, dark line extending from nape to origin of dorsal. Dorsal fin small, slightly in front of anal, its origin midway between posterior edge of opercle and base of caudal fin, the longest rays about equal to base of fin, or half length of head. Length 1½ inches. Coast of Texas; two specimens known. (*Fundulus*; εἶδος, likeness.)

*Zygonectes funduloides*, Evermann, Bull. U. S. Fish Comm., XI, 1891 (May 25, 1892), 85, pl. 35, fig. 3, Dickinson Bayou, Dickinson, Texas,—on Galveston Bay. (Type, No. 45563. Coll. Evermann, Scovell & Gurley.)

## Subgenus ZYGONECTES, Agassiz.

### 950. FUNDULUS DOVII (Günther).

Head 3⅔; depth 5; D. 8; A. 14; V. 6; scales 31–8. Head elongate, low, depressed, the snout much produced, the upper jaw somewhat longer than lower; eye exactly in middle of length of head, its diameter 4½ in head, and more than ½ width of the interorbital space, which is flat. Origin of dorsal a little nearer tip of caudal than to gill opening, over twenty-third scale of lateral series; anal fin entirely before dorsal; pectoral extending to ventral, which reaches vent; caudal rounded; all the fins well developed. Light brownish olive; posterior half of dorsal and anal fins with black cross bands; basal half of caudal with round light spots. Coast of Costa Rica. (Named for Capt. John M. Dow, its discoverer.)

*Haplochilus dovii*, Günther, Cat., vi, 316, 1866, Punta Arenas, Costa Rica. (Coll. Capt. Dow.)

### 951. FUNDULUS MACDONALDI (Meek).

Head 3⅔; depth 4½ to 5; dorsal 11 or 12; anal 12 to 14; scales large, 34 to 36–12. Body rather long and slender, not much compressed; top of head flat; back slightly arched. Teeth rather large, in a narrow band above, those in the outer series enlarged and curved inward. Ventrals very small, and situated midway between pectoral and anal fins; dorsal fin small; anal larger; origin of dorsal behind origin of anal; caudal fin rather large, rounded. Color greenish in spirits, no distinct markings, darker on upper portion of body; both jaws more or less edged with blackish. Closely allied to *Fundulus sciadicus*, but with larger anal fin, more slender body, and rather stronger teeth. Length 2½ inches. Tributaries of the Gasconade and Neosho rivers, in southern Missouri. (Named for Marshall McDonald, United States Fish Commissioner, under whose direction the explorations of the Ozark region were made.)

*Zygonectes macdonaldi*, Meek, Bull. U. S. Fish Comm., ix, 1889 (1891), 122, pl. 42, fig. 1, Jones Creek, Dixon, Missouri; Osage Fork of Gasconade River at Mansfield; Neosho River, Missouri. (Coll. Meek, Drew & Rettger.)

### 952. FUNDULUS FLORIPINNIS (Cope).

Head 4⅓; depth 5; eye large, 3⅕ in head. D. 10; A. 13; scales 29–10. General form of *Fundulus notatus*; lower jaw somewhat projecting; external series of teeth in both jaws enlarged. Olive gray, scales with ocher borders; fins yellow, broadly edged with crimson. Length 2½ inches. Platte River and Arkansas River in Colorado; our specimens from Denver, where it is rare; also recorded from Cherry Creek, a tributary of the Arkansas. A very pretty little fish. (*flos*, flower; *pinna*, fin.)

*Haplochilus floripinnis*, Cope, Zoöl. Wheeler Survey, 695, pl. 28, figs. 4, 4a, and 4b, 1875 (1876), Cherry Creek, Arkansas River, Colorado, and Platte River at Denver. (Coll. H. W. Henshaw and J. M. Keasbey.)

*Zygonectes floripinnis*, Jordan & Gilbert, Synopsis, 339, 1883.

### 953. FUNDULUS JENKINSI (Evermann).

Head 3½; depth 4½ (4⅕ to 5); eye 3½ (3⅕ to 3⅗). D. 8 or 9; A. 12 (11 to 13); scales 33–10, 18 before the dorsal. Body moderately elongate, head depressed, wide between the eyes, pointed, the snout about ¼ greater than eye, which is contained 1½ times in interorbital width; mouth rather large, little oblique; teeth in more than one series, the outer enlarged, pointed, and slightly curved inward; humeral scale small, three rows of scales on cheek. Fins medium, dorsal slightly behind anal, midway between tip of caudal and posterior rim of orbit, the distance from tip of snout to origin of dorsal being twice the distance from that point to base of caudal fin; dorsal and anal low, their longest rays half length of head; base of anal 2½ in head; pectorals 1¾ in head; ventrals short, 1½ in pectoral; caudal fin truncate, about as long as head; peritoneum black. Color pale olivaceous, covered except on breast with numerous minute dark brown specks, arranged chiefly along the edges of the scales, thus giving the sides and back a checkered or crosshatched appearance; in addition to these fine punctulations, there are usually 15 to 30 larger spots more or less definitely arranged in two rows lying along or above the axis of the body; in some examples these spots are absent or blended so as to form short, indistinct vertical bars; in most specimens there is a very obscure lateral band about 1 scale in width; fins plain or with few very minute punctulations; top of head dark. Coast of Texas; not rare in brackish water. (Named for Dr. Oliver Peebles Jenkins, who studied with Dr. Evermann the fishes of the Gulf of California.)

*Zygonectes jenkinsi*, EVERMANN, Bull. U. S. Fish Comm., XI, 1891 (May 25, 1892), 86, pl. 36, fig. 2, Dickinson Bayou, Galveston Bay, Texas. (Type, No. 45562. Coll. Evermann, Scovell & Gurley.)

### 954. FUNDULUS PULVEREUS (Evermann).

Head 3½; depth 4½; eye 3½. D. 10 or 11; A. 10 (occasionally 9); scales 35–11, about 22 before the dorsal. Body stout, heavy forward; head broad and flat, the snout short and blunt; caudal peduncle long, deep, and greatly compressed; eye moderate, 1½ in interorbital width, greater than snout; humeral scale not enlarged, four rows of scales on cheek; mouth rather small, but little oblique; teeth pointed, in more than one series, the outer enlarged and canine-like; peritoneum pale. Dorsal slightly in advance of anal, its origin midway between tip of caudal and anterior rim of orbit, or about midway between base of caudal and opercular opening; anal small, its longest rays 1½ in head. Color in alcohol, olivaceous, profusely sprinkled or dusted all over except on breast with very fine brown punctulations, so abundant on back as to obscure the individual specks; median line of back with a black stripe from occiput to dorsal fin; sides with 10 to 12 or more brown spots of larger size, these sometimes arranged somewhat definitely in two longitudinal lines, in the upper one of which the spots are confluent in some examples, forming large, oblong blotches; all the fins except the ventrals with numerous very small brown specks. Length 2 inches. Coast of Texas in brackish water; not rare. (*pulvereus*, powdery.)

*Zygonectes pulvereus*, EVERMANN, Bull. U. S. Fish Comm., XI, 1891 (May 25, 1892), 85, Dickinson Bayou, Buffalo Bayou at Houston, and Oso Creek at Corpus Christi, Texas. (Type, No. 45561. Coll. Evermann, Scovell & Gurley.)

### 955. FUNDULUS ARLINGTONIUS (Goode & Bean).

Head 3⅓; depth 4; eye longer than snout, 3 in head. D. 9; A. 11; V. 6; scales 33–11. Snout broad. Lower jaw projecting. Dorsal inserted midway between posterior margin of eye and tip of tail, opposite sixth ray of anal; pectorals reaching ventrals; ventrals to vent. Male unknown; female uniform brownish olive; fins in some specimens with 2 or 3 series of blackish dots. (Goode & Bean.) Arlington River, a tributary of St. John's River; known from young females only; most likely a *Zygonectes* rather than a *Gambusia*, though it may possibly prove to be the female of *Gambusia affinis*.

*Gambusia arlingtonia*, GOODE & BEAN, Proc. U. S. Nat. Mus., 1879, 118, Arlington River, Florida; (Type, No. 21308. Coll. Dr. Goode); JORDAN & GILBERT, Synopsis, 345, 1883.

### 956. FUNDULUS HENSHALLI (Jordan).

Head 3½; depth 4. B. 5; D. 7 or 8; A. 10 or 11; scales 33–10. Body rather stout, deep, and compressed, the profile nearly straight, the back little elevated, and the caudal peduncle deep; head moderate; mouth rather large; jaws each with a series of long and rather slender canine-like teeth, behind which is a band of small teeth; the canines larger in the lower jaw; eye large; scales rather large; dorsal fin short and high, inserted slightly behind the anal in the males, exactly opposite it in the females; caudal large; anal fin larger and rather lower than dorsal; ventrals quite small; pectorals moderate. General color olivaceous; sides covered, especially posteriorly, with rather large, irregularly placed orange spots, which also extend on the vertical fins; dorsal dusky, with a dark bar; head without red; caudal and anal more or less yellow; females obscurely marked; young with diffuse greenish vertical bars. Length 3 to 4 inches. Rivers and swamps of southern Florida. The largest species of the group called *Zygonectes*. We cannot always separate young specimens from *F. rubrifrons*, and perhaps, as Dr. Bean has suggested, the two are not really different. It is barely possible that *F. arlingtonius* is the young of *F. henshalli*, but the insertion of the dorsal is apparently different. (Named for Dr. James A. Henshall, its discoverer, well known as a writer on angling.)

*Zygonectes henshalli*, JORDAN, Proc. U. S. Nat. Mus., 1879, 237, San Sebastian River, Florida; (Type, No. 23449. Coll. Dr. Henshall); JORDAN & GILBERT, Synopsis, 338, 1883; JORDAN, Proc. U. S. Nat. Mus., 1884, 322.

### 957. FUNDULUS RUBRIFRONS (Jordan).

Head 3¼; depth 3¾; eye large, 3½ in head. D. 7 or 8; A. 8 or 9; scales 32–11 or 12; B. 5. Body moderately stout, little compressed, not elevated, the caudal peduncle deep; head rather long, broad between the eyes, flat above; mouth rather large. Teeth small, nearly even, in a narrow band. Scales moderate. Dorsal fin very short and small, placed a little behind the anal or about even with it, its position in the males rather more posterior; anal short, high in the males; ventrals very small; pectorals small. Color: males, dark olivaceous, with a dark, bronze-orange spot on each scale posteriorly, much as in *Fundulus catenatus;* below, these spots are bright orange; faint, narrow, vertical orange bars along the lower and posterior part of the body; vertical fins with orange spots; jaws and space in front of eyes bright orange red; paired fins dusky. Females almost uniform brassy olivaceous, without evident spots or red markings. Length 2½ to 3 inches. Streams and swamps of eastern Florida; a larger species than most in the genus, and with the dorsal fin less posterior. (*ruber*, red; *frons*, forehead.)

*Zygonectes rubrifrons*, JORDAN, Proc. U. S. Nat. Mus., 1879, 237, San Sebastian River, Florida. (Type, No. 23450. Coll. Henshall); JORDAN & GILBERT, Synopsis, 338, 1883.

*Zygonectes auroguttatus*,* HAY, Proc. U. S. Nat. Mus., 1885, 556, Westville, Florida. (Type, No. 37362. Coll. Mann & Davison.)

### 958. FUNDULUS SCARTES, Meek.

Head 3⅓; depth 4; eye 3½, about equal to snout. D. 8; A. 10 or 11; B. 4; scales 36–11. Body compressed, back slightly arched, head depressed in usual way. Mouth small, subterminal, lower jaw projecting slightly. Interorbital space 1½ eye. Dorsal fin short, beginning slightly behind anal; neither fin reaching caudal. Teeth in narrow bands, outer row enlarged. Scales large, closely imbricated and minutely spotted with black. Color dark green above, becoming lighter below; belly yellowish; large spots of white on some of the scales giving appearance of several ill-defined silver bars on sides. Two small specimens, the longest 1½ inches long, from St. Francis River, Big Bay, Arkansas.† (*σκάρτης*, one who leaps.)

*Fundulus scartes*, MEEK, Bull. U. S. Fish Comm., xv, 1895, St. Francis River, Big Bay, Arkansas. (Type, No. 47301; co-type, No. 2277, L. S. Jr. Univ. Mus. Coll. Meek.)

### 959. FUNDULUS SCIADICUS, Cope.

Head 3½ to 3¾; depth 4; eye 3¾; snout 3¼ to 3¾. D. 10; A. 12; scales 34–12. Interorbital width 1½ times eye. Body short and stout. Fins small; origin of dorsal behind that of anal and nearer tip of caudal than occiput. Color uniform olivaceous, without spots or lines, in spirits; profusely covered with fine brownish punctulations; belly paler; in life, rosy olivaceous on back and sides; median line of back darker. Abundant in ponds and sluggish, grassy creeks in eastern Nebraska and southeastern South Dakota, where our specimens were collected by Evermann and Cox in 1893. Length 2½ inches. (*σκιά*, shade; *σκιάδης*, name of some dusky fish.)

*Fundulus sciadicus*, COPE, Proc. Ac. Nat. Sci. Phila., 1865, 78, Platte River, Nebraska; (Coll. Dr. Hammond); EVERMANN & COX, Bull. U. S. Fish Comm., xv, 1895.

*Haplochilus sciadicus*, GÜNTHER, Cat., vi, 316, 1866.

*Zygonectes sciadicus*, JORDAN & GILBERT, Synopsis, 342, 1883.

### 960. FUNDULUS LUCIÆ (Baird).

Head 3½; depth 4¼ to 4½; eye 3. D. 8; A. 10; scales 34 or 35–10. Dorsal fin inserted behind front of anal and lower than the latter; when flexed, its extremity is opposite tip of anal; ventral fins small, about equal to head behind eye, or half the length of pectorals, their extremity reaching anus. Vertical bars 10 to 12 in number, sharply defined, their width being equal to the interspaces and slightly increasing toward the tail; these bars begin and end abruptly, not reaching the median line above or below by about half the width of the eye; opercles, cheeks, and chin thickly covered with dark spots, largest on the cheeks and opercles, and least numerous on the cheeks; upper parts, in life, of a dark-green color, which fades into reddish yellow on sides and abdomen; inferior fins pale yellowish; the vertical bars rich black, with a bluish reflection; dorsal with a pale tip and a dark base anteriorly; on dorsal behind a jet-black rounded ocellate spot about ⅔ width of eye and involving rather more than half width of fin, margined anteriorly and inferiorly by a pure white spot. Atlantic Coast from Long Island to Virginia; rare; a pretty little fish only lately rediscovered by Dr. Hugh M. Smith, from whose account the above description is compiled. (Named for Miss Lucy Baird, daughter of Professor Baird.)

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* We place *auroguttatus* in the synonymy of *rubrifrons* on the authority of Dr. Bean, who has compared the types.

† "The species is very abundant in the St. Francis River. I got none in the net, however, but caught the two type specimens in my hand. They keep close to the surface of the water where vegetation is so thick that it is difficult to propel a dugout. These little fishes jump out of the water and remain a short time perched on the weeds. They are very quick. They are usually much smaller in size than the two type specimens."—*Meek in lit.*

*Hydrargyra luciæ*, BAIRD, Ninth Smithson. Rep., 1854 (1855), 344, Beasley's Point, New Jersey. (Coll. Prof. Baird.)

*Haplochilus luciæ*, GÜNTHER, Cat., VI, 316, 1866.

*Zygonectes cingulatus*, JORDAN & GILBERT, Synopsis, 342, 1883.

*Zygonectes luciæ*, HUGH M. SMITH, Bull. U. S. Fish Comm., X, 1890 (1892), 68, pl. 18, fig. 3; (description and figure from specimens taken in the Potomac).

### 961. FUNDULUS CHRYSOTUS, Holbrook.

Head 3½; depth 3⅘. D. 9; A. 11; scales 32 or 33–12. Body short and robust; caudal peduncle high and compressed, its least height 1¾ in head; head short, wide, and flat, the interorbital width ½ its length. Teeth in jaws in a narrow band, the outer series much enlarged, those in the lower jaw larger and more numerous than those of the upper. Snout very short and blunt, the jaws nearly equal in closed mouth; length of snout nearly ⅔ diameter of orbit, which is contained 1½ times in interorbital width, and 3⅓ times in head. Origin of dorsal midway between tip of caudal and posterior rim of orbit, its distance from base of caudal ½ distance from front of orbit; base of dorsal 2½ in head, its height 1⅘ in head, and its origin opposite the nineteenth scale of lateral line and the third ray of the anal fin; base of anal fin rather less than half length of head, its greatest height somewhat more than half; dorsal and anal not nearly reaching caudal when depressed; caudal broadly rounded; pectorals reaching ventrals, 1⅖ in head; ventrals short, not nearly reaching vent, 2 in head. Color in spirits: light olive brown, top of head and a narrow median streak in front of dorsal fin darker; middle of sides, especially behind, with rather indistinct pearl-colored dots; middle of sides of trunk and tail with about 14 not clearly defined, narrow half-bars; an elongate dark area above base of pectorals; vertical fins with small, black specks, less numerous on caudal fin; other fins plain. Length 2 inches. This description from a specimen from Black River, South Carolina; others from New Orleans agree closely. In specimens from Peace River, Florida, Woolman counts 35 to 38 scales, and these may be identical with *F. scartes*. Coastwise swamps, South Carolina to Florida; rather common; known from *F. cingulatus* by the longer anal fin. (*χρυσωτός*, gilded.)

*Fundulus chrysotus*, Holbrook, MS., 1860.

*Haplochilus chrysotus*, Günther, Cat., vi, 317, 1866, Charleston, South Carolina.

*Zygonectes chrysotus*, Jordan & Gilbert, Synopsis, 342, 1883; Jordan, Proc. U. S. Nat. Mus., 1884, 319.

*Zygonectes cingulatus*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 586; not of Cuvier & Valenciennes.

### 962. FUNDULUS CINGULATUS, Cuvier & Valenciennes.

Head 3½; depth 3¾; eyes moderate, 3½ in head. D. 7; A. 8; scales 34–10. Body rather short and deep, compressed posteriorly; back elevated; caudal peduncle deep. Head not large, flat, broad between the eyes; mouth moderate; outer row of teeth long and slender, behind which is a band of smaller teeth; large teeth nearly equal in each jaw. Scales large. Dorsal fin short, its rays moderate, 2¼ in head; anal larger than the dorsal, its rays long, 2 in head; ventrals short, 2½ in head; pectorals 1¾ in head. General color olivaceous; scales edged with dusky, forming a few faint longitudinal stripes; about 15 faint dark vertical bars, interspaced with light orange, which is more plain posteriorly; almost everywhere numerous, small, black points; belly orange; fins all blood red, fading to dusky in alcohol. South Carolina to Florida, in coastwise swamps; not rare; here described from the specimens taken by Bollman in Escambia River at Flomaton, Alabama. (*cingulatus*, belted.)

*Fundulus cingulatus*, Cuvier & Valenciennes, Hist. Nat. Poiss., xviii, 197, 1846; (D. 8; A. 10); "United States."

*Zygonectes cingulatus*, Jordan,* Proc. U. S. Nat. Mus., 1886, 527, redescription of type; Bollman, Proc. U. S. Nat. Mus., 1886, 463.

### 963. FUNDULUS NOTTII † (Agassiz).

(Star-headed Minnow.)

Head 3⅔; depth 4½; eye large, 2⅔ in head. D. 7 or 8; A. 9 or 10; scales 36-10. Form of body much like that of *Fundulus dispar*, compressed behind. Head broad and somewhat concave above, narrow below; interorbital space fully ½ the length of head, 1⅓ the diameter of eye; snout obtuse, shorter than eye; outer row of teeth, above and below, enlarged and recurved. Pectoral fin ⅔ the length of the head; ventrals slightly shorter, attaining the vent; dorsal and anal low, little higher than ½ the length of the head; first ray of dorsal situated slightly behind the first anal ray, and over about the seventeenth scale in the longitudinal series; distance from the snout to the first dorsal ray passing beyond the tips of the caudal rays; distance from the first dorsal ray to the base of the caudal reaching forward to the insertion of the pectoral. Belly and ground color on lower half of body silvery; sides with 6 narrow longitudinal black stripes running from the head to the tail; these stripes a little narrower than the interspaces and perfectly distinct even on the caudal peduncle, the upper stripe rather faint and succeeded higher up by 1 or 2 other obsolete stripes; interspaces of the stripes occupied, especially above, by a row of black dots forming the fainter interrupted stripes of Professor Agassiz's description; on the back these rows of dots are rather more distinct than the continuous stripes; a median dorsal stripe present; about 10 transverse bars of the width of the longitudinal stripe, but fainter, and placed about 2 scales' width apart, on the posterior half of the body; lower surface of caudal peduncle dotted with black, a black streak behind the edge of the opercle; upper surface of the head dusky and also the snout and tip of lower jaw; a broad black mask covering the eyes and extending downward over the cheeks; upper half of the operculum, the space in front of the eye, and most of the lower jaw, orange red; lower half of the operculum and anterior half of breast yellowish orange. Swamps and streams of Florida and neighboring States; not rare. Length 1½ inches. (Gilbert.) A beautiful and strikingly colored little fish. We follow Dr. Hay in identifying *Zygonectes craticula* with *Fundulus nottii*. According to Dr. Gilbert, *Zygonectes zonifer* is the male of *Fundulus nottii*. (Named for Dr. Nott, its discoverer.)

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* *Fundulus cingulatus*, Cuvier & Valenciennes. In the original type, head broad and flat; eye large, 3 in head. Distance from front of dorsal to caudal half the distance to front of eye. Teeth rather strong. Caudal long. D. 7; A. 8. Scales about 33–10, but as some are lost, this count is uncertain. Head 3⅔ in length; depth 4½. Body crossed by (about 16) narrow cross bands, which are quite distinct, and narrower than the interspaces. Region below eye silvery, not dark.

† The following is the scanty original description of this species:

*Zygonectes nottii*, Agassiz: "The darker continuous longitudinal lines alternate with fainter interrupted ones. Males with distinct transverse bands; dark olive above, fading upon the sides; silvery below. Operculum, throat, and space in advance of the eye orange color. Collected by Dr. Nott at Mobile, Alabama."

*Zygonectes nottii*, Agassiz, Amer. Journ. Sci. & Arts, 1854, 353, Mobile, Alabama; Jordan & Gilbert, Synopsis, 341, 1883; Hay, Proc. U. S. Nat. Mus., 1885, 557.

*Zygonectes lineolatus*, Agassiz, Amer. Journ. Sci. & Arts, 1854, 353, Augusta, Georgia.

*Fundulus zonatus*, Cuvier & Valenciennes, Hist. Nat. Poiss., XVIII, 196, 1846, interior of South Carolina; not *Esox zonatus*, Mitchill, with which it has been identified.

*Zygonectes craticula*,* Goode & Bean, Proc. U. S. Nat. Mus., 1882, 433, Elbow Creek, a tributary of Indian River, eastern Florida. (Type, No. 31439. Coll. Henshall.) Jordan & Gilbert, Synopsis, 892, 1883.

*Zygonectes zonifer*, † Jordan & Meek, Proc. U. S. Nat. Mus., 1884, 482, Allapaha River, Nashville, Georgia. (Type, No. 28505. Coll. W. J. Taylor.)

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* The following is a description of the types of *Zygonectes craticula*:
Head 3⅔; depth 5. D. 8; A. 9; scales 40–10. Body comparatively long and slender, little compressed. Caudal peduncle long, rather slender. Head long, broad and depressed above. Eye large, about equal to snout, ⅔ interorbital width, 3¼ in head. Lower jaw heavy. Teeth small, the outer scarcely enlarged. Fins all small. Olivaceous; sides with about 6 sharply defined, jet-black longitudinal stripes following the rows of scales, the stripes a little narrower than the interspaces; a large blackish blotch below eye; fins nearly plain, the upper somewhat dusky; young with faint dark bars.

† The following is a description of the types of *Fundulus zonifer* (Jordan & Meek):
Head 3⅞; depth 4⅖. D. 7; A. 9. Scales 36–11. Body moderately elongate, compressed, the head broad and depressed, the anterior profile somewhat concave above eyes. Head rather pointed in profile, snout nearly as long as eye, which is about half the broad interorbital space and 3⅕ in head. Teeth quite small, the outer little enlarged. Scales rather small. Dorsal fin much smaller than anal, and inserted nearly over the end of the first third of that fin. Anal higher than dorsal, as well as longer, both fins highest in the male, in which they reach very nearly to base of caudal. Insertion of dorsal midway between front of eye and tip of caudal. Caudal rounded, about as long as head. Least depth of caudal peduncle half length of head. Pectorals 1⅓ in head, reaching slightly past front of ventrals. Ventrals nearly reaching anal, 1⅔ in head. Male dark olive above, with the edges of the scales a little darker; sides somewhat silvery, with 12 sharply defined black crossbars, not half as wide as the interspaces, nearly vertical, those near the middle of the body a little farther apart and a little more distinct than the others; no longitudinal streaks; fins without ocelli; caudal entirely plain; dorsal and anal with distinct cross streaks of dark dots. Other specimens (perhaps females) with the color a little darker; the black cross bands broader and more sharply defined; a conspicuous black blotch below the eye; fins colored as in the others. Length 2¾ inches. Swamps of South Carolina and Georgia, the 3 types from Allapaha River, Nashville, Georgia, a tributary of the Suwannee.

### 964. FUNDULUS GUTTATUS (Agassiz).

Head 3¾; depth nearly 5; eye large, 3 in head. D. 6 or 7; A. 8 or 9; scales 36–12. Body elongate, moderately stout, compressed posteriorly; back slightly elevated; caudal peduncle moderate. Head moderate, flat above, broad between the eyes; mouth moderate; jaws armed with an outer series of rather long and slender teeth, behind which is a band of smaller teeth. Scales moderate. Dorsal fin short and small, its height 2 in head, its insertion opposite that of the anal in the female, but a little more posterior in the male; anal short, rather high, 1½ in head; ventrals just reaching vent, nearly 2 in head; pectorals 1½ in head. General color in life orange brown; each scale with a black edge, these forming distinct longitudinal stripes; upper surface of head dark; jaws, opercles, and area in front of eyes bright orange; suborbital region jet black; area above opercle extending across back orange, suffused with dusky; under parts orange; all the fins dusky. In the females the spots on the scales are more suffused. Swamps and streams, Florida to Texas; not rare; here described from Bollman's types of *Zygonectes escambiæ*. (*guttatus*, spotted.)

*Zygonectes guttatus*, Agassiz, Amer. Journ. Sci. & Arts, 1854, 353, Mobile, Alabama; Jordan & Gilbert, Synopsis, 341, 1883.

*Zygonectes escambiæ*, Bollman, Proc. U. S. Nat. Mus., 1885, 463, Escambia River, Flomaton, Alabama; (Type, No. 37995. Coll. Bollman); Evermann, Bull. U. S. Fish Comm., 1891 (1892), 87.

### 965. FUNDULUS HIEROGLYPHICUS (Agassiz).

This species is thus described: "Anterior and upper parts of the body sprinkled with dark dots, passing into longitudinal rows backward. Light olive above; silvery on the sides and below." (Agassiz.) Mobile, Alabama. It has not been recognized by subsequent collectors, but may be distinct. (*hieroglyphicus*, bearing marks like hawk tracks; ἱερός, hawk; γλύφω, cut out.)

*Zygonectes hieroglyphicus*, Agassiz, Amer. Journ. Sci. & Arts, 1854, 353, Mobile, Alabama; Jordan & Gilbert, Synopsis, 341, 1883.

### 966. FUNDULUS DISPAR (Agassiz).

Head 3¾; depth 3½. D. 7; A. 9; scales 35–10. Body short and deep, much compressed. Head short and very broad, the flat interorbital space being ⅔ of its length, and barely twice the diameter of the eye; the distance between the eyes above greater than the distance between them below. Snout broadly rounded. Fins moderate; dorsal much smaller than anal. Outer series of teeth somewhat enlarged. Coloration pale olive, bluish in life; a very distinct brownish line along the edges of each row of scales, appearing wavy or serrated as it follows the scales; about 10 of these longitudinal stripes are present; males with the lines interrupted, appearing as series of dots, and further marked by about 9 dark crossbars; adults with a black blotch below the eye, sometimes confluent with it. Oviduct free from anal. Length 2½ inches. Lakes and sluggish streams from northern Ohio to Missouri, and south to Mississippi; locally abundant; recorded from the Maumee, Wabash, Illinois, Big Black, and Pearl rivers. A chubby little fish, very prettily colored. (*dispar*, dissimilar.)

*Zygonectes dispar*, AGASSIZ, Amer. Journ. Sci. & Arts, 1854, 353, creeks opposite St. Louis, Beardstown, Illinois; JORDAN, Bull. U. S. Nat. Mus., No. 9, 49, 1877; HAY, Bull. U. S. Fish Comm., 1882, 66; JORDAN & GILBERT, Synopsis, 341, 1883.

### 967. FUNDULUS NOTATUS (Rafinesque).

(TOP MINNOW.)

Head 4; depth 4½; eye large, less than snout, about 3 in head. D. 9; A. 11; scales 34–11. Body rather slender, compressed behind. Head low, depressed, and rather elongate, the snout somewhat produced, the lower jaw scarcely projecting; interorbital space broad, its width about half length of head. Fins moderate, the dorsal and anal elevated in the males. Teeth in a broad band, the outer series considerably enlarged and canine-like. Coloration brownish olive, with a broad, dark, purplish-black lateral band running from tip of snout through eye to base of caudal; darker in males than in females; young specimens have the edges of the band serrated; a few series of small black dots along the sides of the back; dorsal, caudal, and anal fins dotted with black; top of head with a conspicuous translucent spot in life; concentric striæ on scales strong. Southern specimens often larger and darker in color. Length 2 to 3½ inches. Michigan to Alabama, Mississippi, and Texas; generally abundant in ponds and canals. A pretty little fish, swimming at the surface in quiet waters, feeding on insects; recognizable in the water by the translucent spot on the head, also found in related species. (*notatus*, spotted.)

*Semotilus notatus*, RAFINESQUE, Ichth. Ohiensis, 86, 1820, tributaries of Ohio River in Ky.

*Pœcilia olivacea*, STORER, Proc. Bost. Soc. Nat. Hist., II, July, 1845, 51, Florence, Alabama. (Coll. C. A. Hentz.)

*Fundulus tenellus*, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1853, 289, Prairie Mer Rouge, Louisiana, and Russellville, Kentucky.

*Zygonectes lateralis*, AGASSIZ, Amer. Journ. Sci. & Arts, 1854, 353, Mobile, Alabama.

*Zygonectes zonatus*, AGASSIZ, Amer. Journ. Sci. & Arts, 1854, 353, St. Louis, Missouri.

*Zygonectes pulchellus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 113, Sugar Loaf Creek, Ark.

*Fundulus aureus*, COPE, Proc. Ac. Nat. Sci. Phila., 1865, 78, Detroit River, Grosse Isle, Mich.

*Zygonectes notatus*, COPE, Bull. U. S. Nat. Mus., XVII, 34, 1880; JORDAN & GILBERT, Synopsis, 339, 1883.

*Haplochilus pulchellus*, GÜNTHER, Cat., VI, 314, 1866.

*Haplochilus aureus*, GÜNTHER, Cat., VI, 315, 1866.

### 968. FUNDULUS MELAPLEURUS (Gosse).

(TICKY-TICKY.)

Head 3⅔; depth 3⅓. D. 11; A. 11; V. 5; scales 31–10. Snout broad and obtuse, the mandible being directed obliquely upward; the diameter of the eye equals the length of the snout, 3 in head and 1⅔ in interorbital space. Dorsal and anal fins of moderate size; the origin of the dorsal midway between the extremity of the caudal and the anterior margin of the orbit, over the sixteenth scale of the lateral line, and opposite the middle of the base of the anal. Free portion of the tail rather short, its depth equal to the distance between the dorsal and caudal fins. Sides of the abdomen silvery, the portion above the silvery part black. Streams of Jamaica; locally common. (*μέλας*, black; *πλευρον*, side.)

*Pœcilia melapleura*, GOSSE, Naturalist's Sojourn in Jamaica, 84, 1851, Jamaica.
*Haplochilus melanopleurus*, GÜNTHER, Cat., VI, 317, 1866.

## 301. ADINIA, Girard.

*Adinia*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 117, (*multifasciata*).

This genus contains species agreeing in general respects with *Fundulus*, but having the aspect of *Cyprinodon*. The gill openings, as in *Cyprinodon*, are restricted, the opercle being adnate to the shoulder girdle as far down as the upper edge of the base of the pectoral. The body is short, deep, and compressed. Besides the two species known to belong to this genus, *multifasciata* and *dugesi*, we provisionally place in it two others, which seem to agree in external characters, though the restriction of the gill openings has not been noticed. (*Adinia*, a coined name without meaning.)

- *a.* Anal with 15 rays; body oblong, the depth 3½ to 4; coloration plain or mottled, without dark cross bands.
  - *b.* Head rather heavy, about 4 in length; depth of body about 4; eye rather shorter than snout, about 4 in head; scales 32 to 35-12; dorsal rays 12. GUATEMALENSIS, 969.
  - *bb.* Head very thick and heavy, about 3⅓ in length; depth 3⅕ to 3⅘; eye shorter than snout, 4 in head; scales 35–12; dorsal rays 13 or 14. PACHYCEPHALA, 970.
- *aa.* Anal with 11 or 12 rays; scales very large; body deep and compressed.
  - *c.* Dorsal rays 15; body crossed by 5 or 6 black cross bands; depth 3 in length; head 3; scales 30–11. DUGESI, 971.
  - *cc.* Dorsal rays 9 or 10; body crossed by 10 to 14 narrow pearly bands; depth 2 to 2½ in length; head 3; scales 25–10. MULTIFASCIATA, 972.

### 969. ADINIA GUATEMALENSIS (Günther).

Head 4; depth 4. D. 12 (13); A. 14 or 15 (16); scales 32 to 35–12. Head thick and broad; interorbital space broad, slightly convex, its width being a little less than half length of head. Snout broad, obtuse; lower jaw slightly projecting beyond upper; mandible longer than eye; eye equal to or, in the larger specimens, less than length of snout, 4 in head, and 2 in interorbital space; origin of dorsal midway between tip of caudal and posterior margin of orbit, over nineteenth scale of the lateral series; first anal ray corresponding to second of dorsal. Dorsal and anal fins subquadrangular, rather low, longer than high in male, and as long as high in female; two-thirds of caudal covered with small scales. Brown above and on the sides, pale below; females with a very indistinct dark band along the side; fins immaculate; anal with a light margin. Sexual opening of the female not attached to the anterior anal rays. Rivers of Guatemala, and southward, to western Ecuador. (Günther.)

*Fundulus guatemalensis*, GÜNTHER, Cat., VI, 321, 1866, Lake of Dueñas; Lake Amatitlan; Rio Guacalate; western Ecuador. (Coll. Salvin & Fraser.)

### 970. ADINIA PACHYCEPHALA (Günther).

Head 3⅓; depth 3⅕ to 3⅘. D. 13 or 14; A. 15; V. 6; scales 35–12. Head very thick and broad; interorbital space very broad, slightly convex, its width being ½ length of head; snout broad, obtuse; lower jaw slightly projecting beyond upper; mandible longer than eye. Eye less than length of snout, 4 in head, and 2 in width of interorbital space. Origin of dorsal midway between tip of caudal and posterior margin of orbit, over sixteenth scale of lateral line; first anal ray under third of dorsal; dorsal and anal fins subquadrangular, of moderate height, the latter fin being scarcely higher than long; caudal fin subtruncate. Brownish above and on sides, each scale darker on tip; an indistinct dark band along middle of tail; fins immaculate, anal with the lower margin whitish. Guatemala. (Günther.) (παχύς, thick; κεφαλή, head.)

*Fundulus pachycephalus*, GÜNTHER, Cat., VI, 321, 1866, Lake Atitlan. (Coll. Salvin.)

### 971. ADINIA DUGESII (Bean).

Head 3; depth nearly 3; eye 4 in head, $\frac{2}{3}$ width of interorbital space. D. 15; A. 11; scales 30–11. Body short and deep, robust; head depressed above; snout short, shorter than eye; jaws short, the upper being freely protractile. Teeth slender, conical, in a double series, those of the outer enlarged. Opercle connected by membrane to the shoulder girdle, beginning at a point in line of lower margin of eye. Anal very short, its base half as long as dorsal base; insertion of dorsal very slightly in advance of anal at a distance from the front of the eye equaling about twice the length of the head, its rays slender, not very long, the longest somewhat shorter than base of fin and less than half head; base of dorsal 2 in head; anal inserted under third ray of dorsal, its longest ray $\frac{1}{3}$ to $\frac{2}{5}$ head; anal base very short, $\frac{1}{2}$ as long as the dorsal base, and very little longer than the eye; pectoral half head; caudal slightly rounded; ventral in middle of length of body, excluding caudal, its tip not reaching vent, 36 in head. Light brown; sides with 5 broad distinct bands or 6 dusky bands, the widest somewhat greater than eye; one of these bands placed under anterior half of the dorsal; sides and head with silver. Length 3 inches. Guanajuato, Mexico. (Bean.) Evidently a species of *Adinia*, as is shown by the form and by the restriction of the gill openings. (Named for its discoverer, Prof. Alfredo Dugès, of Guanajuato.)

*Fundulus dugèsii*, BEAN, Proc. U. S. Nat. Mus., 1887, 373, pl. 20, fig. 5, Guanajuato, Mexico. (Type, No. 37831. Coll. Professor Dugès.)

### 972. ADINIA MULTIFASCIATA,[*] Girard.

Head 3; depth 2 ($2\frac{3}{5}$ to $2\frac{4}{5}$ in ♀); eye large, 3 in head, $1\frac{1}{5}$ in interorbital space. D. 9 or 10; A. 11 or 12; V. 6; P. 14; B. 5; scales 25–10. Body very deep, much compressed, much as in *Cyprinodon*; caudal peduncle very deep; head depressed, rapidly tapering to a sharp, conical snout; the anterior profile somewhat concave; females and young with the back less elevated. Teeth very small, in a villiform band, those of the outer series wide-set and considerably larger; opercle adnate to shoulder girdle above base of pectoral (as in *Cyprinodon* and *Jordanella*). Dorsal inserted in advance of anal, its origin midway between caudal and middle of eye, the longest rays in males reaching base of caudal, $1\frac{2}{5}$ in head; anal lower; ventrals $1\frac{1}{2}$ in head. Intestinal canal as long as body. Male dark green; sides with 10 to 14 narrow, pearly bands, slightly oblique, and mostly narrower than the interspaces; a diffuse, dusky blotch below and behind eye; lower jaw orange; belly yellow; dorsal and anal blackish, with many round, pale-blue spots; orange spots near base of fin; caudal barred, with some pale spots; ventrals dusky, tipped with yellow. female greenish, with a faint, dark lateral shade and some pale cross bands; lower fins largely yellow; upper mostly dusky. Length 2 inches. Gulf Coast, West Florida to Texas; locally very abundant in shallow lagoons; an extremely beautiful little fish, here described from specimens from Pensacola. (*multifasciatus*, many-banded.)

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[*] If the genus *Adinia* is not recognized, this species should stand as *Fundulus xenicus*.

*Adinia multifasciata*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 118, Galveston; St. Joseph Island, Indianola, Texas.

*Fundulus xenicus*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 255, Laguna Grande, Pensacola, Florida; not *Hydrargyra multifasciata*, LE SUEUR, nor *Fundulus adinia*, JORDAN & GILBERT; the name *multifasciatus* preoccupied in *Fundulus*, but not in *Adinia*. (Type, Nos. 29668, 30821, and 30841. Coll. Jordan); JORDAN & GILBERT, Synopsis, 545, 1883.

## 302. RIVULUS, Poey.

*Rivulus*, POEY, Memorias, II, 307, 1860, (*cylindraceus*).

Body rather elongate, subterete, covered with moderate-sized scales. Mouth small, the upper jaw little protractile; snout not produced. Each jaw with a band of villiform teeth and an outer series of curved teeth. Male with the anal fin not modified; oviparous. No air bladder.* Small fishes of the brooks of tropical America, the known species having in one sex at least a large ocellated spot at base of caudal. Some of the species recorded from Venezuela, Colombia, and Trinidad, may occur within our limits. (*rivulus*, a rivulet.)

*a*. Scales small, about 40 in a lengthwise series; dorsal rays 8; anal 12.
  *b*. Insertion of dorsal midway between tip of caudal and center of eye; a black spot on opercle, besides the caudal ocellus of the male. CYLINDRACEUS, 973.
  *bb*. Insertion of dorsal midway between tip of caudal and edge of opercle; body marbled with light and dark spots; male with a caudal ocellus. MARMORATUS, 974.

### 973. RIVULUS CYLINDRACEUS,† Poey.

Head 3¾ in total length; depth 5½; eye 1⅓ in snout, 3½ in head. D. 8; A. 12; scales 40. Body slender, nearly terete; head broader than trunk. Mouth small, little protractile, the maxillary not reaching orbit; teeth in a band with an outer row of stronger ones. Dorsal well backward, behind front of anal, its insertion midway between tip of caudal and center of eye; ventrals short. Green, with violet shades; a large, black, eye-like spot at base of caudal in male; cheek with a green band, ending in a black spot; fins plain greenish or dull orange; female with a black ocellus on opercle, none on the tail; sexes otherwise similar. Length 2 inches. Havana. (Poey.) (*cylindraceus*, like a cylinder.)

*Rivulus cylindraceus*, POEY, Memorias, II, 308, 1861, stream at Mordazo, near Havana; GÜNTHER, Cat., VI, 327, 1866; POEY, Anal. Soc. Esp. Hist. Nat., 247, 1880.

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* The character of the absence of the air bladder has not been verified in either of the following species.

† In Poey's figure of *R. cylindraceus* (1880), the mouth is represented as short and oblique. In the figure in the Enumeratio (V, fig. 4) which Poey refers to *Rivulus marmoratus*, the mouth is larger and nearly horizontal.

### 974. RIVULUS MARMORATUS, Poey.

Differs from *Rivulus cylindraceus* in having the dorsal farther back, the distance of its insertion from the tip of caudal being equal to its distance from edge of opercle; the anal appearing more advanced. Body dashed with light and dark spots; a black caudal* ocellus. Cuba. (Poey.) (*marmoratus*, marbled.)

*Rivulus marmoratus*, POEY, Anales de Hist. Nat. España, IX, 248, 1880, Cuba.

## 303. LUCANIA, Girard.

*Lucania*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 118, (*venusta*); not *Lucanus*, a genus of beetles.

Body oblong, compressed; lower jaw prominent, the cleft of the mouth short and very oblique. Mouth moderate, the snout not produced; each jaw with a single series of conical teeth. Scales very large. Gill openings not restricted. Dorsal and anal rays in moderate number, the dorsal above or slightly in advance of the anal; anal fin not modified in the males; oviparous. Very small fishes of the coastwise swamps of the United States, all of them very prettily colored. (A coined name, without meaning.)

*a.* Body comparatively elongate, the depth $4\frac{1}{4}$ to 5 in length, the form approaching that of *Rivulus*.
  *b.* Body without black longitudinal band in either sex, the female with a caudal ocellus as in *Rivulus*; an ocellus above front of anal; cleft of mouth very short and nearly vertical; dorsal rays 7; anal 8; depth 5 in length. OMMATA, 975.
  *bb.* Body in both sexes with a black longitudinal band from eye to the black caudal spot; male with the basal half of dorsal and anal black, the fins with red in life. Depth $4\frac{1}{4}$ in length. D. 9; A. 9; scales 30–7. GOODEI, 976.
*aa.* Body comparatively short and deep, the depth $3\frac{1}{4}$ to $3\frac{3}{4}$ in length, the form approaching that of *Cyprinodon*; body in both sexes without black longitudinal band or black ocelli; the fins in male with orange, the dorsal in male with a large black spot at base in front.
  *c.* Body more oblong, the depth $3\frac{1}{2}$ to $3\frac{3}{4}$ in length. D. 11 or 12; A. 9 or 10; scales 26–8. VENUSTA, 977.
  *cc.* Body deep, the depth $3\frac{1}{4}$ in length. D. 10; A. 10; scales 26–8. PARVA, 978.

### 975. LUCANIA OMMATA (Jordan).

Head $3\frac{1}{3}$; depth 5; eye $2\frac{1}{2}$. D. 6 or 7; A. 9 or 10; scales 26 to 28–9. Body fusiform, slender, somewhat compressed. Premaxillary very protractile; teeth small, pointed, in one row, the tips not colored. Mouth very small, its cleft almost vertical; ventral surface of lower jaw directed forward so that the fish seems truncated. Eye large, twice length of snout, equal to the flat interorbital space. Gill membranes narrowly connected, free from isthmus. Scales large. Anal inserted slightly in advance of dorsal, not modified in the male; insertion of dorsal midway between edge of opercle and base of caudal; pectorals and ventrals small. Intestine not longer than body. Straw color, a dark vertebral line; male with 5 or 6 dark bars and no caudal ocellus; female with a jet-black spot as large as pupil on side just in front of origin of anal; a larger ocellated spot at upper part of base of caudal, a dark band of minute points nearly connecting the two spots, the band forking before the caudal spot and sending a branch above and below it; a dark streak from base of ventrals along each side of anal to base of caudal; a dark streak from eye covering lower jaw; another faint streak from eye to lateral spot, forking to form an ocellus, as is the case with the caudal spot. Length ¾ to 1 inch. Swamps of Florida; 8 specimens now known; 2 obtained by R. Edward Earll in Indian River, the original types of the species; 2 obtained by Mann and Davison in western Florida, and described by Professor Hay as *Zygonectes mannii*; the others obtained in the Santa Fé River and its tributaries by Mr. A. J. Woolman, who alone has seen the male. In form and color, the species resembles the genus *Rivulus*. It apparently differs in dentition and seems on the whole nearer to *Lucania*. It can not be an ally of *Heterandria*. The largest specimens are barely an inch in length, so that the species may, in the words of Dr. Hay, "contend with *Heterandria formosa* for the honor of being the smallest known vertebrate." (ὀμματός, eyed, in allusion to the caudal ocellus of the female.)

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*Misprinted "pectoral" in Poey's description.

*Heterandria ommata*, Jordan, Proc. U. S. Nat. Mus., 1884, 323, Indian River, Florida. (Type, No. 25331(2). Coll. R. Edward Earll); Woolman, Bull. U. S. Fish Comm., x, 1890, 302.

*Zygonectes mannii*, Hay, Proc. U. S. Nat. Mus., 1885, 555, Yellow Water River, Florida. (Coll. H. T. Mann.)

### 976. LUCANIA GOODEI, Jordan.

Head 4; depth 4¼; eye 2½ to 2¾. D. 9; A. 9; scales 29 to 32-7. Body elliptical, rather elongate, the back considerably elevated to a point just in front of the origin of the dorsal fin; caudal peduncle rather deep and compressed. Head short, comparatively narrow, and bluntly pointed; mouth small, terminal; both jaws with rather large, conical, canine-like teeth, apparently in a single series. Eye large, near the middle of the side of the head, about equal to interorbital space. Scales large; humeral scale like the others. Fins large, especially in the males; origin of dorsal about midway between snout and base of caudal, conspicuously in advance of anal; height of dorsal fin in the males ⅔ length of head, about equal to the length of the base of the fin; anal fin similar and nearly as high and long, beginning nearly under the middle of the dorsal; caudal moderate, subtruncate; ventrals long, in the males reaching the front of the anal, in the females reaching the vent; pectorals reaching past front of ventrals in both sexes. Color olivaceous, the scales with dark edgings; a very distinct black band in both sexes running through eye and snout straight to the base of the caudal, where it ends in a round black spot; this band about as wide as a series of scales, although developed on parts of 2 series; a conspicuous black band in both sexes along lower edge of the caudal peduncle, from root of the caudal to vent, dividing and passing on each side of the anal fin; fins in the female plain; in the male, basal half of dorsal and anal jet black, outer half pale with a black edge; pectorals, and especially ventrals, also dark-edged; caudal fin faintly mottled; vertical fins with more or less red in life. Length 1¼ inches. Rivers of the Everglade region; locally abundant. Known from the Alligator, Arlington, Peace, and Withlacoochee rivers. A very small but prettily colored fish. (Named for Dr. George Brown Goode, its discoverer.)

*Lucania goodei*, JORDAN, Proc. U. S. Nat. Mus., 1879, 240, Arlington River, Florida, a tributary of the St. John's. (Type, No. 23505. Coll. Dr. Goode.) JORDAN & GILBERT, Synopsis, 343, 1883; WOOLMAN, Bull. U. S. Fish Comm., x, 1890, 294, pl. 52, fig. 2.

### 977. LUCANIA VENUSTA, Girard.

Head $3\frac{1}{2}$; depth $3\frac{1}{2}$; eye 3. D. 11 or 12; A. 9 or 10; scales 26–8. Body fusiform, rather strongly compressed, the dorsal and ventral outlines about equally arched; head narrow, compressed, flattened above the eyes, the upper profile of snout both longitudinally and transversely convex; snout compressed, conspicuously shortened, and vertically rounded, its height greater than its width; caudal peduncle long and rather slender, its greatest height $1\frac{2}{5}$ in head, its length slightly less than head; mouth very small, protractile forward, the lower jaw very much projecting in open mouth; mandible heavy, short, and strongly convex, less than diameter of orbit; teeth small, but firm and strong, conical, in a single series in each jaw, or forming an irregular double series anteriorly; no villiform teeth behind this outer series; eye large, slightly shorter than interorbital width, and greater than length of snout. Intestinal canal rather less than length of body. Origin of dorsal fin nearly midway between tip of snout and base of caudal, the longest ray (in ♂) equaling the length of its base; origin of anal fin under middle of dorsal; oviduct not attached to first anal ray, but produced backward, forming a low sheath on both sides at base of first 6 rays; length of anal base $\frac{2}{5}$ head; longest ray (♂) $\frac{1}{2}$ head; caudal $1\frac{2}{7}$ in head; pectorals long, reaching beyond base of ventrals, $1\frac{3}{4}$ in head; ventrals reaching slightly beyond vent, $1\frac{4}{5}$ in head. Color (♂) light olive, pale on belly; sides with some silvery luster and with indistinct trace of an obsolete dusky lateral stripe; scales conspicuously dark-edged; opercles and cheeks bright silvery; dorsal and caudal light yellow, and, as well as the anal, narrowly magined with black; dorsal with an elongate, vertical black blotch at anterior margin, a yellow spot behind it; a vertical dusky streak behind each dorsal ray, composed of fine black points; anal orange or translucent, white at base; ventrals similar to anal; pectorals pale yellowish; a dark vertical streak through iris. ♀ similar, fins all plain. Length about 2 inches. Lagoons and inlets of the coast of the Gulf of Mexico, exceedingly abundant about Pensacola, and westward to the mouth of the Rio Grande; a pretty little fish, here described from Pensacola specimens. (*venustus*, pretty.)

*Limia venusta*, GIRARD, U. S. Mex. Bound. Surv., Ichth., 71, pl. 39, figs 20–23, 1859, Indianola, Texas. (Coll. Clark.)

*Lucania affinis*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 118, Matamoras.

*Lucania venusta*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 118; GÜNTHER, Cat., VI, 310, 1866; JORDAN & GILBERT, Synopsis, 343, 893, 1883; JORDAN, Proc. U. S. Nat. Mus., 1882, 257.

### 978. LUCANIA PARVA (Baird & Girard).

(RAINWATER FISH.)

Head $3\frac{1}{4}$; depth $3\frac{1}{4}$; eye 3. D. 10 to 12; A. 10 or 11; scales 26–8. Body much deeper than in *Lucania venusta*, the form resembling that of

*Adinia.* Females larger than males; both sexes plump. Color in life: Males olive, with bluish reflections; edges of the scales darker; dorsal dusky orange, with a large black spot at the base in front, ocellated with orange; caudal orange yellow, tipped with black; ventrals and anal orange red, tipped with dusky; pectorals translucent. Females with the fins pale olive, without black spot or edgings. Length 1½ to 2 inches. Atlantic Coast from Connecticut to Key West; very common at Key West, in shallow waters and tide pools close to the shore, especially where fresh waters soak in the sea; here described from Key West specimens; equally abundant about the mouth of the Potomac in brackish ponds and tide ditches. (H. M. Smith.) (*parvus*, small.)

*Cyprinodon parvus*, Baird & Girard, Ninth Smiths. Report, 1854 (1855), 345, Greenport, Long Island; (Coll. Baird); Günther, Cat., vi, 307, 1866.

*Lucania parva*, Jordan & Gilbert, Synopsis, 893, 1883; Jordan, Proc. U. S. Nat. Mus., 1884, 109; Hugh M. Smith, Bull. U. S. Fish Comm., x, 1890, 68.

### 304. GIRARDINICHTHYS, Bleeker.

*Girardinichthys*, Bleeker, Cyprin., 481, 1860, (*innominatus*).

*Limnurgus*, Günther, Cat., vi, 309, 1866, (*variegatus*).

Body stout. Mouth small, its cleft nearly vertical; the upper jaw very protractile. Teeth small, pointed, in a single series in each jaw. Scales rather small. Dorsal and anal fins long, each with 20 or more rays, nearly opposite each other; anal fin not modified in the male. Intestinal canal short, about as long as body. Gill membranes partly united, free from isthmus. Very small fishes, differing from *Lucania* in the long dorsal and anal. Mexico. (*Girardinus*; ἰχθύς, fish; named for Dr. Charles Girard, 1822–1895, who studied the fishes of the Mexican Boundary Survey.)

#### 979. GIRARDINICHTHYS INNOMINATUS, Bleeker.

Head 4; depth 3¼; eye 5 in head, 2 in interorbital width. D. 20; A. 22; scales 44. Head thick, the snout obtuse, the mandible being directed vertically upward; neck arched, so that the upper profile of the head is concave. Origin of dorsal midway between occiput and base of caudal. Olivaceous, with irregular dark-brown cross bands, which are sometimes confluent. Sexes similar. Length 2½ inches. Vicinity of City of Mexico; not rare. Our specimens collected by Mr. Amos W. Butler. (*innominatus*, unnamed, Girard having omitted to attach a specific name when describing the species.)

*Lucania, sp.*, Girard, Proc. Ac. Nat. Sci. Phila., 1859, 118, City of Mexico.

*Girardinichthys innominatus*, Bleeker, Cyprin., 484, 1860, after Girard; Jordan & Gilbert, Synopsis, 343, 1883.

*Limnurgus variegatus*, Günther, Cat., vi, 309, 1866; after Girard; the name given by Bleeker being regarded as barbarous.

### 305. EMPETRICHTHYS, Gilbert.

*Empetrichthys*, Gilbert, Death Valley Exped., Fishes, 233, 1893, (*merriami*).

Body rather elongate, the form approaching that of *Fundulus*. Intestine short, 1½ times length of body. Teeth conic, fixed, in each jaw arranged in a band consisting of two or three rows, the outer series somewhat enlarged. Ventrals absent. Branchiostegals five. Both upper and lower pharyngeals greatly enlarged and bearing molar teeth, tubercular in shape; lower pharyngeals firmly attached to the ceratobranchials of the fourth arch, while the massive epibranchials of the same arch serve to connect them firmly at the sides with the pharyngobranchials above; fourth branchial arch bearing normal gills, its median portion produced anteriorly, forming a triangular extension of the lower pharyngeals in the middle line; on the oral surface this is indistinguishable from the pharyngeals proper, and like them bears molar teeth. Scales normal, large, regularly imbricated, nowhere tubercular or ridged. This genus seems to be allied to *Orestias*, a genus likewise devoid of ventral fins, inhabiting the mountain lakes of the Andes. It differs from *Orestias*, as from all other *Cyprinodonts*, in the singular development of the pharyngeals. (ἐν, within; πέτρος, rock; ἰχθύς, fish, in allusion to the stony pharyngeals.)

### 980. EMPETRICHTHYS MERRIAMI, Gilbert.

Head 3⅖; depth 3⅕; eye 5. D. 11 or 12 (13 in one specimen); A. 14 (from 13 to 15). Scales 30 or 31, counted to base of caudal rays, 33 or 34 in all. Head compressed, its upper surface slightly convex. Mouth very oblique, with a distinct lateral cleft, the maxillary free at tip only, reaching slightly behind front of eye. Length of gape (measured from tip of snout to end of maxillary) 3⅓ in head; interorbital width 2½; length of snout (from front of orbit to middle of upper jaw) 3¾. Eye small, its greatest oblique diameter 5 to 5½ in head. Distance from front of dorsal to middle of base of tail ½ its distance from tip of snout. Dorsal beginning slightly in advance of anal, and ending above its posterior third, its greatest height equal to length of snout and eye; caudal truncate when spread; pectorals broadly rounded, reaching half way to vent. Color dark brown above, sides and below lighter, often irregularly blotched with brown and white; the belly often appears checkered, having centers of scales brown and margins white, or the reverse; fins all dusky, the basal portions of dorsal and caudal with elongated brown spots on the interradial membranes. In form and general appearance this singular fish much resembles the mud minnow (*Umbra limi*), though somewhat deeper and more compressed. Springs of the desert about Death Valley in eastern California, a depressed desert tract, intensely hot and almost rainless. (Named for Dr. C. Hart Merriam, the well-known mammalogist, in charge of the Death Valley explorations.)

*Empetrichthys merriami*, GILBERT, Death Valley Exped., Fishes, in North American Fauna, No. 7, 234, pl. 5, May 31, 1893, Ash Meadows, Amargosa Desert, on the boundary between California and Nevada. (Type, No. 46,101. Coll. Merriam & Bailey.)

## 306. CHARACODON, Günther.

*Characodon*, GÜNTHER, Cat., VI, 308, 1866, (*lateralis*).

Body rather deep and compressed. Gill openings restricted, as in *Cyprinodon*.* Mouth small, the teeth small, fixed, bicuspid, or Y-shaped, in a single series, with a band of villiform teeth behind them. Scales moderate. Insertion of dorsal nearly opposite that of anal. Intestinal canal short; bones of jaws well united. Small fishes of the fresh waters of Mexico and Central America. (*χάραξ*, a sharp stake; *ὀδούς*, tooth.)

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* This character not verified in *Characodon lateralis* or *C. furcidens*.

- *a.* Scales rather large, 32 to 35 in longitudinal series.
    - *b.* Dorsal fin small, of 10 or 11 rays; anal rays 13 to 16; scales 35–12; a dark lateral band, sometimes broken into spots. LATERALIS, 981.
    - *bb.* Dorsal fin large, of 13 to 16 rays; depth 3 to 3⅓ in length.
        - *c.* Dorsal rays 16; anal 16; scales 32–11; body with two lateral stripes, the second beginning with front of anal. BILINEATUS, 982.
        - *cc.* Dorsal rays 13 or 14; anal 15 or 16; scales 35–15; males with a faint dark lateral stripe made of dark blotches; female without stripe, irregularly blotched or spotted. VARIATUS, 983.
- *aa.* Scales rather small, about 50 in a longitudinal series; dorsal rays 16; anal 13; depth 3⅗ in length; sides mottled or barred, the fins with dark bars. FURCIDENS, 984.

### 981. CHARACODON LATERALIS, Günther.

Head 3⅓; depth 3; eye 4. D. 10 or 11; A. 13 in female, 15 or 16 in male; scales 35–12. Body rather elevated, with the neck somewhat arched. Head thick and broad, with the snout obtuse, as long as the eye. Mandible ascending obliquely, longer than eye. About 20 smallish teeth in each jaw, their apex indistinctly notched. Interorbital space flat, its width being 2½ in head. Origin of dorsal fin a little nearer end of caudal than to occiput, a little behind that of the anal; both fins small and rounded; in the male the six anterior rays are of nearly equal length, but considerably shorter than the following, forming a very distinct portion of the fin; all these rays are very closely set; caudal fin small, truncate, or slightly convex; distance between dorsal and caudal somewhat more than least depth of tail, and equal to distance between eye and gill opening; pectoral obtuse, not quite reaching ventral; ventral small, not quite extending to the vent. Brownish olive (in spirits), with a darker band running from the eye to the root of the caudal; this band sometimes broken up into a more or less regular series of brownish-black spots. In general habits very similar to a *Cyprinodon*. Central America. (Günther); not seen by us. (*lateralis*, pertaining to the side.)

*Characodon lateralis*, GÜNTHER, Cat., VI, 308, 1866, Central America; (Coll. Dr. Seemann); GÜNTHER, Fishes Central Amer., 480, pl. 82, fig. 2, 1886.

### 982. CHARACODON BILINEATUS, Bean.

Head 3⅔; depth 3; eye 4. D. 16; A. 16; scales 32–11. Head broad and depressed, the interorbital space being nearly flat, the nape moderately arched. Snout short, rather shorter than eye; the lower jaw somewhat prominent; upper jaw moderately protractile. About 20 bicuspid teeth in the outer series of each jaw; villiform teeth behind the incisors evident; mandible nearly vertical when the mouth is closed, nearly reaching eye. Eye scarcely more than ½ interorbital width. Scales on top of head somewhat enlarged. Opercle connected by membrane to the shoulder girdle, beginning at a point slightly above upper edge of pectoral. Insertion of the dorsal midway between the posterior margin of the eye and end of the scales; longest dorsal ray 1½ in head; base of dorsal 5 times in body; anal inserted under third ray of dorsal; pectoral 5 in length of body; length of head contained 3⅔ times in the total without caudal, and much less than the depth at dorsal origin; ventral reaching about to vent, its length nearly ½ head. Upper parts brown; lighter below, probably orange in life; the operculum silvery; a purple stripe along the middle of the body, its greatest width about equal to the length of the eye; abdomen silvery, this color extending up to the purple stripe; a purplish stripe on the edge of the caudal peduncle, from the end of the anal to the caudal. Length 2 inches. Rio Lerma, Guanajuato; one specimen known. (Bean.) (*bilineatus*, two-lined.)

*Characodon bilineatus*, Bean, Proc. U. S. Nat. Mus., 1887, 371, pl. 20, fig. 2, Rio Lerma, Guanajuato, Mexico. (Type, No. 37832. Coll. Dugès.)

### 983. CHARACODON VARIATUS, Bean.

Head 3⅓; depth 3¼; eye 3½. D. 13 or 14; A. 15 or 16; scales 35–15. Head broad and depressed; the nape moderately arched. Snout short, the lower jaw strongly projecting. Thirteen or fourteen bicuspid teeth in outer series of upper jaw and 16 to 18 in lower jaw; band of villiform teeth behind the incisors fully developed in both jaws; mandible not extending back to front of orbit, its length about equal to that of orbit. Jaws moderately protractile. Mandible almost vertical when mouth is closed. Snout shorter than eye, which is about ⅔ interorbital space. Scales on top of head little enlarged. Opercle united by membrane to the shoulder girdle to slightly above the upper edge of the pectoral. Insertion of the dorsal about midway between the end of the scales and the hinder margin of the orbit; longest dorsal ray in male 1½ in head; anal inserted under seventh or eighth ray of dorsal, its longest ray about ⅖ head; pectoral 5⅓ to 6 in length; ventral midway between tip of snout and end of scales. Head ¼ total length including caudal, and equaling depth of body at the dorsal origin. Male chestnut brown, with an indistinct dark lateral stripe made up of a series of interrupted dark blotches; opercle silvery; abdomen yellowish. Female olive brown above, lighter below; the opercle silvery, overlaid below with orange; the abdomen with a yellowish tinge; lips dusky; iris pale; scales of upper half of body dusky at base; lower half of body with numerous dark spots, the largest about as long as the pupil. Length 2 to 3 inches. Tributaries of Rio Lerma, about Guanajuato and City of Mexico; locally common. (*variatus*, variegated.)

*Characodon variatus*, Bean, Proc. U. S. Nat. Mus., 1887, 370, pl. 20, fig. 1, female, Guanajuato, Mexico. (Type, No. 37808. Coll. Dugès.)

*Characodon ferrugineus*, Bean, Proc. U. S. Nat. Mus., 1887, 372, pl. 20, figs. 3 and 4, Guanajuato, Mexico. (Type, No. 37810. Coll. Dugès.)

*Characodon variatus*, Bean, Proc. U. S. Nat. Mus., 1892, 285; according to Dr. Bean, *ferrugineus* is the male of *variatus*.

### 984. CHARACODON FURCIDENS, Jordan & Gilbert.

Head 4; depth 3⅖; eye rather large, 3⅓ in head. D. 15 to 17; A. 13; scales about 50–15. Body comparatively elongate, not greatly compressed, the head rather low and broad, depressed, the profile rising evenly from tip of snout to the nape, the region thence to the dorsal gibbous, especially in the larger examples, the caudal peduncle comparatively long and slender, about as long as head. Anterior teeth large, firmly fixed, all bicuspid or Y-shaped, in a single series; a band of minute villiform teeth behind them, at least in upper jaw. Mandible not extending back to front of eye. Interorbital area wide, very nearly half head. Scales rather small, those on top of head not much longer than others; humeral scale not enlarged. Opercle connected by membrane to shoulder girdle from upper base of pectoral upward, as in *Cyprinodon*. Insertion of dorsal very far back, midway between base of caudal and base of pectoral; first ray of dorsal very slender and articulate, not at all spine-like; dorsal fin low, not so high as long, its base 1⅔ in head; anal inserted below seventh ray of dorsal; pectorals 1⅔ in head; ventrals 2 in head; caudal obliquely truncate, very slightly emarginate, the upper lobe about ⅕ longer than the lower, 1¼ in head; upper lobe usually more or less sharply angular; lower lobe rounded. Males with the sides profusely mottled with darker, sometimes nearly plain; vertical fins each with several brownish bars and blotches and each with a dusky subterminal bar; a narrow dark line along middle of each row of scales on the back. Females with several short, dark bars on the posterior half of the body, the fins colored as in the male; some small, dark specks on caudal peduncle. About Cape San Lucas; locally abundant; and about Colima. (*furca*, fork; *dens*, tooth.)

*Characodon furcidens*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 354, near Cape San Lucas.[*] (Type, Nos. 9571 and 30971. Coll. Xantus.)

## 307. CYPRINODON, Lacépède.

### (PURSY MINNOWS.)

*Cyprinodon*, LACÉPÈDE, Hist. Nat. Poiss., v, 486, 1803, (*variegatus*).
*Prinodon*,[†] RAFINESQUE, Analyse de la Nature, 1815, 88, (*variegatus*).
*Trifarcius*, POEY, Memorias, II, 306, 1861, (*riverendi*).

Body very short and stout, the back elevated. Mouth small, the bones of the jaws well formed. Snout short. Teeth moderate, incisor-like, tricuspid, in a single series. Scales very large. Dorsal fin moderate, inserted in advance of front of anal, its first ray not enlarged; anal smaller; ventral fins small, occasionally wanting in specimens from desert pools. Intestinal canal little longer than body. Gill membranes considerably united, free from the isthmus. Gill openings restricted, the opercle above adnate to the shoulder girdle. Chubby little fishes, inhabiting the brackish waters of Middle America,[‡] sometimes living in warm salt springs, their colors generally brilliant. Oviparous, the sexes similar except in color. (*κύπρινος*, carp; *ὀδούς*, tooth.)

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[*] Probably from the lagoons at La Paz.

[†] This name was offered as a substitute for *Cyprinodon*, the latter being regarded as too long.

[‡] The European and African species commonly referred to this genus seem to represent a distinct generic type, *Lebias*, Cuvier, (=*Micromugil*=*Aphanius*), distinguished by the freedom of the opercle, and by the more elongate form, resembling *Fundulus*. Of these species, *Lebias calaritanus* from the Mediterranean is the best known, and is the only one on which these characters have been verified.

*a.* Scales large, 24 to 26 in lengthwise series; sides without dark lateral band.

*b.* Sides with dark bars in the female, nearly plain in the males; females with black ocellus on last rays of caudal; male with tip of caudal black.

*c.* Body deep, the depth nearly or quite half length of body in males, the females more elongate.

*d.* Humeral scale* considerably enlarged.

*e.* Dorsal rays usually 11; anal rays 10.

*f.* Head moderate, about 3½ in body; male with the back largely blue in life, the lower parts coppery; caudal in male with a dusky bar at tip, the base dusky or pale; unspotted; tips of dorsal dusky. VARIEGATUS, 985.

*ff.* Head larger, about 3¼ in body; male with the caudal speckled at base; this followed by a pale bar and a black one; dorsal pale. EXIMIUS, 986.

*ee.* Dorsal rays 9; anal rays 8; head very large, about 3 in length; coloration dark. BOVINUS, 987.

*dd.* Humeral scale little enlarged; dorsal rays 9 to 11; head 3 to 3¼ in length; depth nearly 2; scales 24 or 25.

*g.* Anal rays 10 or 11; males dusky, the fins all margined with black; females barred with black and usually with black dorsal ocellus; ventral fins often absent. MACULARIUS, 988.

*gg.* Anal rays 13; sides with two lengthwise series of coarse black spots; no ventral fins in specimens known. BAILEYI, 989.

*cc.* Body comparatively slender, the depth 2⅔ to 3 in length; dorsal rays 11; anal 10; head rather large, 3⅓ in length; dorsal spotted or clouded at base. ELEGANS, 990.

*ccc.* Body more elongate, the depth nearly 4 in length; dorsal 9; anal 10; scales 26–9. MARTÆ, 991.

*bb.* Sides in males with faint coppery bars and yellow spots; fins tipped with orange; females with oblong blotches of bright orange; no dorsal ocellus, humeral scale not enlarged; depth 2⅖ in length; head 3. D. 11; A. 9; scales 24. CARPIO, 992.

*aa.* Scales smaller, 30 in a lengthwise series.

*h.* Sides without longitudinal stripe, but with six brown cross bands (in male); caudal with a black bar at tip and a fainter one at base. D. 12; A. 10. FELICIANUS, 993.

*hh.* Sides with a dark horizontal lateral band, bordered on each side by a light band; caudal with a narrow dark band at base and a very broad one at tip. D. 12; A. 11. LATIFASCIATUS, 994.

## 985. CYPRINODON VARIEGATUS, Lacépède.

(SHEEPSHEAD MINNOW; PURSY MINNOW.)

Head rather small, 3¼ to 3⅗; depth 2 to 2⅔; eye 3½; interorbital width 3 in head. D. 11; A. 10; B. 6; scales 26–13. Body very short and robust, in adults high and much compressed, the females abruptly constricted at base of caudal peduncle; caudal peduncle rather short and high, rapidly narrowed backward to tail, its greatest height nearly equal to length of head, its least height ½ head; head short, little depressed, narrowed upward and forward, with sharp snout and small mouth; width of mouth rather less than length of snout; teeth large, in a single series, consisting of wedge-shaped incisors, much widened toward tips, the cutting edge tricuspid; no villiform teeth; eye moderate, its diameter longer than mandible, slightly less than interorbital width, about equal to length of snout. Opercle joined by membrane to shoulder girdle from a point slightly above base of pectoral. Intestinal canal long, but not much convoluted, 2⅔ times length of body. Dorsal moderate, in females as high as the length of its base, in males much higher; origin of dorsal midway between base of caudal and end of snout; base of fin 1⅓ to 1⅔ in length of head; longest ray (in male 2 inches long) reaching halfway from base of fin to base of caudal, the anterior rays equaling length of head and extending beyond tips of posterior rays when the fin is depressed; in females the longest ray about 1½ in head; origin of anal under eighth or ninth ray of dorsal, the fin very small, and much higher than long; length of base about equaling snout; longest ray half length of head (less in females). No external oviduct. Caudal truncate or slightly emarginate, 1¼ in head; ventrals, in adult males, reaching front of anal, 2⅓ in head; in females reaching vent; pectorals long, reaching middle of ventrals, 1⅙ in head. Scales large, tuberculate in males, arranged in regular series; humeral scale much enlarged, its height nearly half length of head; 26 or 27 oblique series of scales from opercle to base of tail; 13 scales in an oblique series from vent to middle of back. Color: Male olivaceous; from dorsal forward above pectoral to head deep, lustrous steel blue, the color very intense and conspicuous in life; rest of upper parts with rather greenish luster, becoming dull slaty blue, and on cheeks, opercles, sides anteriorly, and belly deep salmon color; lower lip and preopercle violet; dorsal blackish, the anterior margin of fin orange; caudal dusky olive, with a jet-black bar at tip, and a narrow black cross-streak at base; anal dusky at base, bordered entirely around with bright orange; ventrals dusky, bordered with orange; pectorals dusky orange, darker below. Smaller specimens show some orange shading on the sides, and sometimes also traces of the cross-bands of the female. Female very light olive; lower half of sides with about 14 alternately wide and narrow vertical, dark bars, those anteriorly narrower and closer together; usually 7 or 8 dark crossbars on the back, alternating with the wide bars below; these bars are of various degrees of distinctness, sometimes almost obsolete; a dusky area below eye; young with broad greenish cross shades wider than the interspaces; belly pale or yellowish; lower jaw largely blue; cheeks brassy; dorsal dusky, with an intense black, faintly ocellated spot near tip of last rays; caudal faintly reddish, with a black bar toward base; other fins pale orange, with some dark points. Length: Male 3 inches; female 2 inches. Cape Cod to the Rio Grande, in brackish waters, entering streams, very abundant southward, the males more highly colored southward, but the southern form (called *gibbosus*) not otherwise different. (*variegatus*, variegated.)

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* Character not verified in *C. bovinus* or in *C. elegans.*

*Cyprinodon variegatus*, Lacépède, Hist. Nat. Poiss., v, 486, 1803, South Carolina; Günther, Cat., vi, 305, 1866; Jordan & Gilbert, Synopsis, 329, 1883.

*Esox ovinus*, Mitchill, Trans. Lit. and Philos. Soc., i, 1815, 441, New York.

*Lebias ellipsoidea*, Le Sueur, Journ. Ac. Nat. Sci. Phila., ii, 1821, 6, Florida.

*Lebias rhomboidalis*, Valenciennes, Humboldt's Observ. Zoöl., ii, 100, 1817, Lake Pontchartrain, Louisiana.

*Cyprinodon gibbosus*, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1853, 390, Indianola, Texas; (Coll. Clark); Girard, U. S. Mex. Bound. Surv., Ichth., 67, 1859; Jordan & Gilbert, Synopsis, 329, 1883.

*Lebias ovinus*, De Kay, N. Y. Fauna: Fishes, 215, 1842.

Represented in the Florida Keys and Cuba by

### 985a. CYPRINODON VARIEGATUS RIVERENDI (Poey).

Head 3⅓; depth 2. D. 10; A. 9; scales 24–12. This form is very close to the form described as *C. gibbosus*, but with larger scales and the anal edged with black. Male in life with the antedorsal region lustrous steel blue, the rest of the body olivaceous, obscurely clouded, but without dark crossbars; a black bar at base of dorsal; a dark shade below eye; anal and caudal edged with black; ventrals and anal red; dorsal dusky, edged with orange; pectoral plain, tipped with orange and blackish. Female more silvery, the back olivaceous and speckled; the sides with about 13 blackish bars, which do not reach the back; these alternately broad and narrow; no yellowish shades; a dusky bar through eye; lower fins whitish; upper pale; dorsal fin with a black ocellus; dark band across base of caudal. Length 2½ inches. Cuba and Florida Keys. Rather common at Key West in shallow waters near the shore. (Named for M. L. Riverend, a naturalist in Havana.)

*Trifarcius** *riverendi*, POEY, Memorias, II, 306, 1861, Havana.
*Cyprinodon riverendi*, JORDAN, Proc. U. S. Nat. Mus., 1884, 109.

### 986. CYPRINODON EXIMIUS, Girard.

Head 3⅓; depth nearly 2; eye 4 to 4½ in head. D. 11 or 12; A. 9 to 11. Head large; anterior profile more arched than in *C. variegatus*; back very convex. Insertion of dorsal over that of ventrals, slightly nearer base of caudal than tip of snout. Mouth small, the lower jaw prominent. Male dark, nearly plain, the base of caudal with many longitudinal black spots, which do not form a crossbar; the fin with a broad black tip, before which is a rather broader pale bar; dorsal fin light yellow, its base dusky; lower fins plain or slightly dusky. Female without black on tip of caudal, but with a black spot on dorsal behind; females and young with black crossbars. Length 2½ inches. Chihuahua River. Close to *C. variegatus*, but differing in the color of the caudal and in the larger and more arched head. Our specimens from Rio de los Conchos, obtained by Mr. Woolman. (*eximius*, choice, excellent.)

*Cyprinodon eximius*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 158, Chihuahua River; JORDAN & GILBERT, Synopsis, 890, 1883.

### 987. CYPRINODON BOVINUS, Baird & Girard.

Head 3; depth about 2¼; eye 4 in head. D. 9; A. 8; scales (in figure) 24. Apparently very similar to *C. eximius*, about equally deep, but said to have a larger head, the ventrals under the front of the dorsal. Male uniform blackish above, the fins unicolor except the caudal which is tipped with black, its base unspotted; female with the sides blotched, the fins plain, except for the dorsal ocellus. Leon Spring, in southwestern Texas. (Girard.) (*bovinus*, like a bull.)

*Cyprinodon bovinus*, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1853, 389, Leon Spring, Texas; (Coll. Clark); GIRARD, U. S. Mex. Bound. Surv., Ichth., 67, pl. 37, figs. 12–18, 1859.

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*The nominal genus, *Trifarcius*, based on the presence of 6 branchiostegals, is identical with *Cyprinodon*; the same number being found in *Cyprinodon variegatus*, contrary to the statement of Valenciennes.

### 988. CYPRINODON MACULARIUS, Baird & Girard.

Head 3 to 3¼. Adults very short and deep, the depth being nearly or quite half the length; in half-grown specimens 1 inch long, the depth is contained 2⅖ in length. D. 9 to 11; A. 10 or 11 *; V. 6; scales 24 or 25. Eye very small, about equal to snout, 1½ to 1⅔ times in interorbital width, and 3⅔ times in head. Front of dorsal usually midway between occiput and base of caudal. The species varies in form and color, and apparently in the size which it reaches in different localities. Males with the back and sides uniform dusky, the lower parts lighter, all the fins in the most brightly colored individuals being broadly margined with black; females with the lower half of sides as well as belly lighter, often silvery white, the sides crossed by black bars, which are wide along middle of body, but become much narrower than the interspaces on the lower half of sides; these bars varying in number and size and often alternating with narrower, fainter, and shorter ones; fins light, the dorsal either with or without a black blotch on its posterior rays. Although usually uniform in coloration, the males occasionally show lateral bars, which, however, contrast little with the general dusky color of the sides. (Gilbert.) Springs and streams of the desert, from southern Nevada to Sonora; locally abundant. (*macularius*, spotty.)

*Cyprinodon macularius*, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1853, 389, Rio San Pedro, Arizona; GIRARD, U. S. Mex. Bound. Surv., Ichth., 68, pl. 37, figs. 8–11, 1859; JORDAN & GILBERT, Synopsis, 330, 1883; GILBERT, Death Valley Exped., 232, 1893.

*Cyprinodon californiensis*,† GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 157, San Diego County, California, probably from salt springs in the desert; JORDAN & GILBERT, Synopsis, 330, 1883.

*Cyprinodon nevadensis*, EIGENMANN, Proc. Cal. Ac. Nat. Sci., 1889, 270, Saratoga Springs, Death Valley, Inyo County, California.

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*The normal number of ventral rays in this species seems to be 6. No specimen examined has shown more than this number, and in several but 5 are present. In one specimen from Ash Meadows, Nevada, the ventral fin of one side only is present, and contains but 3 or 4 rays. Four young specimens from the same locality and 2 from Medbury Springs, Amargosa Desert, California, have the ventrals wholly aborted, and show on dissection no trace of the basals. These occur in the same lots with other specimens having normal ventrals, and are otherwise indistinguishable from them. No full-grown adults were found without ventrals, the largest being a half-grown specimen about 1 inch long with the characteristic coloration of the males already developed. Ten young specimens from the "Devil's Hole," Ash Meadows, are all without ventrals, and further collections from this locality would be of interest. In the intestines were found fragments of insects, and in one series of specimens from Saratoga Springs at the south end of Death Valley, California, very numerous shells of a small Gasteropod mollusk. Specimens are in the collection from the following localities: Medbury Spring (6 miles north of the Borax Works), Amargosa Desert, California; Ash Meadows, Amargosa Desert, Nevada; Saratoga Springs, Death Valley, California; Amargosa Creek, California.—*Gilbert.*

† *Cyprinodon californiensis* is thus described: "It may be easily distinguished from its congeners in North America by its uniform system of coloration, which exhibits neither bands nor spots. The general aspect of its body is rather short and deep, except in the young, which assume a subfusiform appearance. The largest specimens which we have examined measure about an inch and a half in total length. The head constitutes the fourth of the length, the snout being abruptly rounded off. The mouth is, proportionately speaking, of medium size, whilst the eye is rather small, subcircular; its diameter entering three times and a half in the length of the side of the head. The dorsal fin is higher than long, and superiorly convex; its interior margin being nearer the apex of the snout than the posterior margin of the caudal. The anal fin is nearly as large as the dorsal, deeper than long, inferiorly convex, particularly upon its posterior half. The caudal is posteriorly truncated, nearly linear. The ventrals are small, project beyond the vent and reach almost the origin of the anal. The pectorals are well developed, rounded off, extending as far as a vertical line drawn at the insertion of the ventrals. The rays are: D. 10 + 1; A. 11; C. 3, 1, 8, 8, 1, 3; V. 7; P. 12. The scales are much deeper than long, anteriorly truncated and posteriorly rounded off or convex. The color is olivaceous brown, with a dark-grayish tint along the back, and a golden tint beneath."—*Girard.* San Diego County, California.

### 989. CYPRINODON BAILEYI (Gilbert).

To this species are referred 11 immature specimens from Pahranagat Valley, Nevada, none of them showing trace of ventral fins. They are olivaceous above, bright silvery on the lower half of sides and below, and have 2 lengthwise series of coarse black spots, 1 along middle line of body, the other on a level with the lower edge of caudal peduncle. The anal fin is larger than in typical *macularius*, the 11 specimens having each 13 rays instead of 10 or 11, as constantly in the latter. Pahranagat Valley, Nevada. (Gilbert.) Perhaps a variety of *C. macularius*. (Named for Vernon Bailey, its discoverer.)

*Cyprinodon macularius baileyi*, Gilbert, Death Valley Exped., Fishes, 233, 1893, **Pahranagat Valley, Nevada.** (Type, No. 46110. Coll. Merriam & Bailey.)

### 990. CYPRINODON ELEGANS, Baird & Girard.

Head 3½; depth 2½ to 3. D. 11; A. 10; scales 26–12. Body more elongate than in any of the preceding; the upper outline of the head less depressed, so that the profile is continuous; fins low, the dorsal quite small; its rays scarcely extending to the beginning of the caudal peduncle. Head large. Bluish black, sides somewhat variegated with darker, the males somewhat spotted; dorsal fin speckled at base; edge of caudal fin black in the male; a black patch on last rays of dorsal in the female. Length 2½ inches. Tributaries of the Rio Grande; specimens apparently belonging to this species from Rio de los Conchos, at Chihuahua. This species may prove inseparable from *C. bovinus*. (*elegans*, elegant.)

*Cyprinodon elegans*, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1853, 389, **Camanche Spring, Texas**; (Coll. Clark); Girard, U. S. Mex. Bound. Surv., Ichth., 66, pl. 37, figs. 1–7, 1859; Jordan & Gilbert, Synopsis, 319, 1883.

### 991. CYPRINODON MARTÆ, Steindachner.

Head 3½; depth nearly 4; eye 3 in head; snout 3⅔. D. 9; A. 10; V. 7; P. 16; scales 26–9. Body rather elongate; snout blunt; teeth tricuspid, in 1 row; top of head broad; dorsal and anal very high in male, the height of dorsal 2½ times its base, the last rays reaching beyond base of caudal; insertion of anal under middle of base of dorsal; insertion of dorsal nearer that of caudal than tip of snout by half length of head; ventral as long as head, equal to pectoral; caudal weakly concave; scales largest about shoulder and nape. Back grayish; sides silver white; male with anterior margin of dorsal dusky; last 3 or 4 rays of dorsal and anal banded, for their whole length, with light and dark in alternation, the others more faintly marked and only toward their base; 2 or 3 dark bands on caudal, the last broadest. One specimen known, from Santa Marta, on the Caribbean coast of Colombia, near the mouth of Rio Magdalena.

*Cyprinodon martæ*, Steindachner, Ichth. Beitr., iv, 61, 1875, **Santa Marta.**

### 992. CYPRINODON CARPIO, Günther.

Head 3; depth 2⅖; eye in adult 3⅓ in head. D. 11; A. 9; scales 24–9. Body comparatively elongate, rather strongly compressed; head large;

profile not very steep; fins rather low, the dorsal and anal not nearly reaching caudal; humeral scale not larger than the others; scales very thick and firm, those on lower parts of body less reduced in size than usual. Pectorals reaching middle of ventrals, which reach vent. Male in life light olive; sides silvery, with 6 narrow, faint bars of coppery; sides with a number of spots of bright clear yellow, besides the blotches of orange found in the females; lower jaw mostly golden; 3 bright-yellow stripes obliquely across the cheeks to the jaws; dorsal and caudal finely speckled with olive; tip of dorsal orange, as also the lower edge of caudal and anal; ventrals orange red; no ocellus on dorsal. Female pale, with numerous blotches of light bright orange, these mostly longitudinally oblong on upper parts and irregular or vertical below; sides of head marked with bronze; lower jaw whitish; fins plain; dorsal and caudal slightly yellow. Young females with traces of 1 or 2 dusky bars at base of caudal. Still younger specimens (as in the original types) nearly plain silvery. Coasts of southern Florida. Exceedingly abundant in lagoons and shallow shores about the Florida Keys and north to Pensacola. A strongly marked species, larger than most others of the genus, reaching a length of 3 inches; here described from Key West specimens. (*carpio*, carp.)

*Cyprinodon carpio*, Günther, Cat., vi, 306, 1866, America, locality unknown; Jordan & Gilbert, Synopsis, 330, 1883.

*Cyprinodon mydrus*, Goode & Bean, Proc. U. S. Nat. Mus., 1882, 433, Pensacola, Florida. (Type, No. 30479. Coll. Stearns.) Jordan, Proc. U. S. Nat. Mus., 1884, 110.

### 993. CYPRINODON FELICIANUS (Poey).

Head 3⅕ in length with caudal; depth 2¾; eye 3½ in head. D. 12; A. 10; scales 30. Back elevated; mouth small, circular, with trifid teeth. Pectoral reaching vent; ventral small; male with small prickles on the scales. Brownish, the belly yellow, reddish in life; body with 6 brown vertical bands; dorsal dusky; pectoral and anal yellowish, edged with dusky; caudal yellowish, with a terminal band of black, a rather faint bar at base. Length 1⅔ inches. Cuba. (Poey); not seen by us. (Named for Felix Garcia y Chavez, of Havana.)

*Trifarcius felicianus*, Poey, Synopsis, 412, 1867, Havana. (Coll. Poey.)

### 994. CYPRINODON LATIFASCIATUS, Garman.

Head 4 in total length; depth 3. D. 12; A. 11; V. 6; P. 14; scales 30–11. Form and dentition of *C. variegatus*, the black caudal band much wider; a light band from middle of opercle to lower half of caudal; a dark band above this, separated by a narrower band of light from the dark olive of the back; silvery color of belly separated from the light band on the flanks by a short band of brown; fins clouded with brown; caudal with a narrow dark band across its base and a broad one across its extremity. Parras, Coahuila, Mexico. (Garman); not seen by us. (*latus*, broad; *fasciatus*, banded.)

*Cyprinodon latifasciatus*, Garman, Bull. Mus. Comp. Zoöl., viii, No. 3, 92, 1881, Parras, Coahuila, Mexico; Jordan & Gilbert, Synopsis, 329, 1883.

## 308. JORDANELLA, Goode & Bean.

*Jordanella*, Goode & Bean, Proc. U. S. Nat. Mus., ii, 1879, 177, (*floridæ*).

Body short, deep, compressed. Head short. Mouth small, very protractile, the lower jaw the longer; lips full. Jaws each with a single series of rather broad, wedge-shaped, incisor teeth, the cutting edge of which is deeply notched, usually trifid. Branchiostegals 5. Gill openings narrowed, the opercular membrane adnate to the opercle above. Dorsal fin elongate, the number of rays 16 to 18, the first being a robust spine; insertion of dorsal fin behind ventrals, in advance of front of anal, its last ray behind the last of anal; dorsal fin not greatly elevated; anal fin shorter and smaller, similar in both sexes; ventral fins small, with a scale at base; caudal fin rounded; pectorals short and small. Intestinal canal rather long, 3 times length of body. Sexes similar. (Named for David Starr Jordan.)

### 995. JORDANELLA FLORIDÆ, Goode & Bean.

Head 3½; depth 2 to 2¼; eye large, 3½ to 4. D. I, 14 to 16; A. I, 11 to 13; scales 25 to 27–11 or 12. Body ovate, short, and deep, with elevated back, deep caudal peduncle, and steep profile. Head moderate, flat and broad between the eyes, its profile less steep than that of the back. Mouth small, anterior, the lower jaw projecting. Scales moderate, the humeral scale not much enlarged. Dorsal fin inserted midway between snout and base of caudal, its first ray robust and spine-like, grooved behind, longer than the diameter of the eye and about as high as the succeeding soft rays; fins all rather low, the ventrals reaching just past the vent. Scales with strong concentric striæ; scales of side with occasional developed pores, sometimes forming 2 or 3 imperfect lateral lines. Color olivaceous; sides orange or brassy, with a broad steely-blue stripe along each series of scales; 4 or 5 vague, diffuse, black vertical bars, most distinct in the young, nearly obsolete in the adult; a large, diffuse, dusky blotch on the sides below the dorsal spine; fins mostly dark, the dorsal barred or speckled in the males, nearly plain in the females, sometimes a dusky blotch on its last rays; body and fins everywhere finely punctulate with black; a dark bar below eye. Length 2½ inches. Streams and swamps of Florida; abundant. A singular little fish having the aspect of a Centrarchoid.* Here described from specimens taken by Dr. J. A. Henshall in San Sebastian River. Herbivorous, at least in part. Specimens are recorded from San Sebastian, St. Johns, Alligator, Withlacoochee, Hillsboro, Pease, and Myakka rivers; also from Lake Monroe, Lake Jessup, Lake Tohopekaliga, and other waters around Kissimee in Osceola County, Florida.

*Jordanella floridæ*, Goode & Bean, Proc. U. S. Nat. Mus., ii, 1879, 117, Lake Monroe, Florida. (Type, No. 18062. Coll. Professor Baird); Jordan & Gilbert, Synopsis, 328, 1883; Woolman, Bull. U. S. Fish Comm., x, 1890, 300, with good figure; Lönnberg, Øfvers. Vet. Akad. Förh., 115, 1894.

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* "I do not know if it can be proper to talk about mimicry in this case, but *Jordanella* is certainly in coloration very much indeed similar to a small *Chænobryttus gulosus*. Even the black spot on the opercle flap of the latter corresponds very well to the black spot on the side of *Jordanella*, and as the head of the 'War-Mouth' is so much larger it is situated not much farther back than in *Jordanella*. It is possible that through this likeness some fishes that feed on minnows can be cheated to believe that they have a war-mouth that is less delicious and maybe can defend itself with mouth and spines before their eyes, instead of a harmless minnow." (Einar Lönnberg, *l. c.*, 115, 1894.)

## 309. PSEUDOXIPHOPHORUS, Bleeker.

*Pseudoxiphophorus*, BLEEKER, Ichthyol. Ind. Prodr. Cypr., 483, 1860, (*bimaculatus*).
*Pœcilioides*, STEINDACHNER, Sitzgsber. Akad. Wiss. Wien, 1863, 176, (*bimaculatus*).

This genus has the general characters of *Gambusia*, differing in the larger size of the dorsal fin, which has 13 to 16 rays instead of 6 to 10. Anal fin short, less advanced in the male than in *Gambusia*. The species reach a much larger size than those of *Gambusia*. The males, as in *Gambusia*, are smaller and less numerous than the females. Mountain streams of Mexico. (*ψευδής*, false; *Xiphophorus*.)

### 996. PSEUDOXIPHOPHORUS BIMACULATUS (Heckel).

Head 4; depth 3¾; eye longer than snout, 3½ in head. D. 12 or 13; A. 10; scales 30–8. Head broad and flat, its width between the eyes 2 in length. Lower jaw projecting. Anal process ending in a small hook. Length of dorsal equal to head, its front in advance of front of anal. Color light brown, each scale above and back of abdomen with a dark-brown crescent; all the scales, fins, and mouth parts profusely spotted with brown; a black spot behind upper end of gill opening and a round blackish spot on upper half of root of caudal; a black bar composed of black spots at base of dorsal and anal; a second series of dark spots on dorsal not quite corresponding to the first series. Length 3 inches. Central Mexico, generally abundant; here described from numerous specimens from Rio Blanco, at Orizaba, where it is abundant in the swift waters of mountain streams. This is the only species thus far known in Rio Blanco above the cataracts. (Woolman.) (*bimaculatus*, two-spotted.)

*Xiphophorus bimaculatus*, HECKEL, Sitzgsber. Akad. Wiss. Wien, 1848, 196, Mexico.
*Pseudoxiphophorus reticulatus*,[*] TROSCHEL, Müller's Reise Mexico, III, App. 638, 1865, no locality; GÜNTHER, Cat., VI, 333, 1866; JORDAN & GILBERT, Synopsis, 344, 1883.
*Pseudoxiphophorus bimaculatus*, GÜNTHER, Cat., VI, 332, 1866; JORDAN & GILBERT, Synopsis, 344, 1883; WOOLMAN, Bull. U. S. Fish Comm., XIV, 1894, 65.
*Pœcilioides bimaculatus*, STEINDACHNER, Sitzgsber. Akad. Wiss. Wien, 1863, 176.

## 310. GAMBUSIA, Poey.

### (GUAJACONES.)

*Gambusia*, POEY, Memorias, I, 382, 1855, (*punctata*).

Body moderately elongate, becoming deep in the adult female. Mouth moderate, larger than in *Pœcilia*, the lower jaw projecting, the bones well joined; both jaws with a band of pointed teeth which are not movable; snout not produced. Eyes normal, not divided. Scales large. Gill openings not restricted. Dorsal and anal fins both rather short and small, the anal more or less in advance of the dorsal; anal fin of the male much advanced and modified into a long intromittent organ, which is about as long as head. Intestinal canal short. Branchiostegals 6. Vertebræ about 32. Small viviparous fishes inhabiting the swamps, springs, and ponds of Mexico, Cuba, and the Southern States, swimming near the surface and feeding chiefly on insects or small crustacea. The males are slenderer than the females and very much smaller; compared with the females, the males are very rare, and not often collected. ("The name owes its etymology to the provincial Cuban word *Gambusino*, which signifies 'nothing,' with the idea of a joke or farce. Thus one says 'to fish for *Gambusinos*' when one catches nothing." Poey.)

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[*] *Pseudoxiphophorus reticulatus*, TROSCHEL. Our specimens of this nominal species show the following characters:

Snout broad, spatulate, the lower jaw projecting. Eye equal to snout, 3½ in head, 2 in interorbital space. Anal process in male 1½ head with a slight curve at its tip. Caudal peduncle short. Anal fin inserted in front of dorsal. Dorsal long, its length 3 in body. Coloration as in *P. bimaculatus*, but darker and more profusely dotted with brown. A large black spot on upper half of root of caudal, and traces of another behind gill opening. Occiput and snout dark brown. Scales on back and sides with a dark-brown crescent. These do not appear on scales of lower parts as in *bimaculatus*; dorsal fin with dark-brown cross streaks made of dark spots. Fins, scales, cheeks, and opercles profusely dotted with brown. Head 3½; depth 4. D. 15; A. 8; scales 31–8. Length 2½ inches. Hitherto known from one specimen. Here described from two males and one female from Rio Blanco at Orizaba, collected by A. J. Woolman. This form occurs in company with *P. bimaculatus*; the two can scarcely be separated, and are probably not really different, but, as Mr. Woolman has already suggested, simply extremes of variation.

*a.* Scales rather small, about 35 in a lengthwise series; dorsal rays 10; anal 11; head 4⅙ in length; depth 3¾; back and dorsal fin with a series of black dots. PUNCTATA, 997.

*aa.* Scales large, 26 to 32 in a lengthwise series.

*b.* Anal rays 11; dorsal rays 9; scales 30; head 4 in length; depth 3⅔; body and fins with black dots; a black band below eye. PUNCTICULATA, 998.

*bb.* Anal rays 7 to 10, usually 9.

*c.* Body without dark cross bands.

*d.* Body without dark lateral band or with merely a faint, narrow, dark lateral streak; general color olivaceous, dotted.

*e.* Origin of dorsal fin over origin of anal (in male); scales large, 26. D. 8; A. 8; color nearly plain. INFANS, 999.

*ee.* Origin of dorsal fin in the female about over middle of anal; body usually dotted above, and with a faint dark line along sides, sometimes plain olivaceous; usually a jet-black blotch below eye, this sometimes obsolete; dorsal and caudal usually with cross series of dots; gravid female with a black blotch on side, the black interstructures showing through the silvery peritoneum.

*f.* Body moderately stout, the depth 3⅔ to 4 in length; deepest in adult females; back not much elevated; head moderate, 3⅔ to 4 in length; dorsal rays 8 or 9, (rarely 6 or 7); anal rays 8 to 10; scales 30 to 32. AFFINIS, 1000.

*ff.* Body very robust, the depth 3 to 3½ in length; back much elevated; head large, 3 to 3½ in length; dorsal rays 8; anal 9; scales about 30; sides of belly anteriorly with many dark points, these sometimes forming an indistinct band from gill opening to ventrals. NOBILIS, 1001.

*ee.* Origin of dorsal fin in the female over last ray of anal; olivaceous, with brown dots along series of scales; dorsal and caudal with series of dark dots; middle of anal blackish. D. 8; A. 10; scales 29-8; head 3⅔ in length; depth 3⅓. NICARAGUENSIS, 1002.

*dd.* Body with a dark band from upper edge of gill opening to caudal; anal process bent in male.

*g.* Insertion of dorsal not far behind that of anal. D. 8; A. 8 or 9; scales 29-7 head 4 in length; depth about 3¾. GRACILIS, 1003.

*cc.* Body with more or less distinct dark cross bands, sometimes replaced by a series of dots; a black spot in both sexes on middle of base of anal; fins dotted. D. 8 or 9; A. 10; scales 28-7; head 3½ to 3¾; depth 3¾ to 4. EPISCOPI, 1004.

*ccc.* Body black, marbled with yellow; depth equal to length of head, 5 in total length with caudal; insertion of dorsal behind middle of total length. PICTURATA, 1005.

### 997. GAMBUSIA PUNCTATA, Poey.

(GUAJACON.)

Head 4⅙; depth 3¾; eye 3. B. 6; D. 10; A. 11; V. 6; scales 35; vertebræ 13+20. Lower jaw projecting beyond upper. Eye half width of interorbital space. Origin of dorsal in female midway between tip of caudal and front margin of orbit, opposite seventh or eighth anal ray; origin of dorsal in male in middle of the total length; anal process of male shorter than head; pectoral fins not quite reaching as far as ventrals; length of base of anal fin of the female ½ its distance from caudal. Upper half of body and dorsal fin with series of black dots. Rivers of Cuba; very common; our specimens from Rio Almendares. (*punctatus*, speckled.)

*Gambusia punctata*, POEY, Memorias, I, 384, 1855, Cuba; GÜNTHER, Cat., VI, 334; JORDAN, Proc. U. S. Nat. Mus., 1886, 34.

### 998. GAMBUSIA PUNCTICULATA, Poey.

Head 4; depth 3⅔; eye 3 in head. B. 6; D. 9; A. 11; V. 6; scales 30; vertebræ 13 + 19. Lower jaw projecting beyond the upper. Origin of dorsal in female midway between extremity of caudal and center of eye, opposite middle of anal; in male origin of dorsal in the middle of total length; anal process of male longer than head; pectoral and ventral fins short; free portion of tail rather deep. Body with scattered black dots; an oblique blackish band below the eye; dorsal and caudal fins with transverse series of black dots. Streams of Cuba. (Poey.) (*puncticulatus*, dotted.)

*Gambusia puncticulata*, POEY, Memorias, I, 386, 1855, Cuba; GÜNTHER, Cat., VI, 334, 1866.

### 999. GAMBUSIA INFANS, Woolman.

Head 4⅕; depth 4⅕. D. 8; A. 8; scales 26. Body slender. First rays of dorsal midway between snout and end of caudal, or midway between the posterior margin of opercle and end of scales; insertion of anal almost directly beneath first rays of dorsal; base of dorsal very short, slightly more than length of orbit; diameter of orbit a little greater than length of snout, about 2⅞ in head; modified anal of males about 1½ times length of head, or about equal to the distance from insertion of dorsal to end of scales; ventral fin short, not reaching vent. Back light olive green; but few scales with dark edges or other marking except a very narrow hair line along the middle of the caudal peduncle from the dorsal to end of scales, and another line of about equal length and breadth, but more distinct, which extends along the lower edge of the caudal peduncle from the last rays of anal to the caudal fin; coloration of types very pale, probably a result of life in muddy water. Length 1½ inches. Rio Lerma, about Salamanca, Mexico; only male specimens known. (*infans*, infant, from the small size.)

*Gambusia infans*, WOOLMAN, Bull. U. S. Fish Comm., XIV, 1894, 62, pl. 2, fig. 3, Rio Lerma, Salamanca, Mexico. (Type, No. 45570. Coll. Woolman & Cox.)

### 1000. GAMBUSIA AFFINIS (Baird & Girard).

(TOP MINNOW.)

Head 3¼ to 4; depth 3⅔ to 4. D. 7 to 9; A. 8 to 10; scales 29 to 32, usually 30–8 to 10. Body rather plump, large specimens becoming deep. Head moderate, very broad and much depressed; teeth in broad villiform bands; eye moderate, 1½ to 1¾ in interorbital width, 3 to 3½ in head.

Intestinal canal as long as body. Dorsal small, far back; distance from its insertion to caudal half that to snout, its first ray about over middle of anal; anal larger and higher than dorsal. Light olive, each scale edged with darker; a very narrow dark streak along sides; top of head dusky; a more or less distinct triangular bluish-black bar below eye; sides and belly anteriorly dusky with dark dots; a black blotch on each side of belly, caused by the black internal organs showing through the skin; young specimens often uniform yellowish; fins dusky; the caudal usually with cross series of dots. Length 1½ to 2 inches. Males very scarce,[*] and very small, about ½ to 1 inch long, the anal process as long as head. The ordinary form, to which the name *patruelis* has been given, has usually 8 dorsal rays, a dark suborbital bar, and the fins more or less speckled. Some specimens from Texas have fewer spots, the body and fins nearly plain, and the dorsal rays 6 or 7. These differences are probably of little value. If, however, the distinction holds good, the common form (Delaware to Texas) should stand as subspecies *patruelis*, the name *affinis* having priority; the names *holbrooki*, *melanops*, and *atrilatus* being synonyms of *patruelis*. Marshes and lagoons of the South Atlantic and Gulf coasts, Delaware to Mexico, and north to southern Illinois, in brackish or fresh water; excessively common southward, usually in clear water, but in sluggish rather than running streams. The young are produced in summer, when about ⅛ of an inch long.[†] (*affinis*, related, to *G. holbrooki.*)

*Heterandria affinis*,[‡] Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1853, 390, Rio Medina and Rio Salado, Texas. (Coll. Clark.)

*Heterandria patruelis*, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1853, 390, Rio Sabinal, Rio Nueces, and Elm Creek, Texas. (Coll. Clark.)

*Heterandria holbrooki*, Agassiz, MS., 1854, Charleston, South Carolina.

*Gambusia holbrooki*, Girard, Proc. Ac. Nat. Sci. Phila., 1859, 61, Palatka, Florida; Günther, Cat., vi, 334, 1866.

*Gambusia speciosa*, Girard, Proc. Ac. Nat. Sci. Phila., 1859, 121, Rio San Diego, New Leon, Mexico; said to have fin rays in small number; not counted in description.

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[*] Of 69 examples from the lower Potomac examined by Dr. Hugh M. Smith, 68 were females. The stomach of one specimen contained algæ, diatoms, and fragments of a mosquito.

[†] "Mr. A. A. Duly has informed me that he has witnessed the act of copulation and the birth of the young of *Gambusia*. In coitus the male's head is turned in the direction of the tail of the female, the prolonged anal fin seeming to be thrust into the external opening of the ovarian duct or genital pore of the female, which lies just in advance of the anal fin. The young, when born, are stated by Mr. Duly to be about ⅜ of an inch in length, and to be expelled in a single mass, consisting of 8 to 11 young fishes at a single effort. This mass, as soon as it escapes, is seen to be composed of the infant *Gambusias*, which at once separate and swim away. No membranes seemed to be expelled together with the mass of young, so that it is probable that in this species, as in *Anableps* and the *Embiotocidæ*, the fœtuses rupture the follicles in which they were developed a short time before birth. I say a short time before birth, because our observations indicate that, unlike *Anableps* and *Micrometrus*, the development of *Gambusia* is essentially completed within the follicles, and no yelk sac remains outwardly visible when the young are set free. My informant also tells me that the parent fishes devoured their young as soon as they were born if they were not separated, by transferring one or the other at once to another aquarium. Fright seemed to hasten or precipitate the parturition, which Mr. Duly tells me actually took place under such circumstances. He also noticed that more than one brood seemed to be produced by the same parent consecutively and during the same season, and he has reason to think that more may have been produced, as his observations only extended over the latter part of summer with adults brought from Cherrystone, in August and September, which he kept in aquaria in the National Museum." (Ryder, Proc. U. S. Nat. Mus., 1885, 155.)

[‡] *Gambusia affinis* (Baird & Girard): Body moderately stout. Dorsal and anal fins similar in size and shape, the latter not much advanced. Coloration plain; dorsal and caudal dotted with black. Head 4; depth 3⅘. D. 6; A. 8.—*Girard.*

*Gambusia gracilis*,* Girard, Proc. Ac. Nat. Sci. Phila., 1859, 121, Matamoras, Mexico; name preoccupied.

*Gambusia humilis*, Günther, Cat., VI, 334, 1866; substitute for *gracilis*, preoccupied; Jordan & Gilbert, Synopsis, 345, 1883.

*Haplochilus melanops*, Cope, Proc. Amer. Phil. Soc., 1870, 457, Neuse River, North Carolina. (Coll. Cope.)

*Zygonectes atrilatus*, Jordan & Brayton, Bull. U. S. Nat. Mus., XII, 84, 1878, Neuse River, Goldsboro, North Carolina; (Coll. Brayton & Gilbert); Jordan & Gilbert, Synopsis, 340, 1883.

*Zygonectes brachypterus*,† Cope, Bull. U. S. Nat. Mus., XX, 34, 1880, Trinity River, Fort Worth, Texas; (Coll. Cope); Jordan & Gilbert, Synopsis, 341, 1883.

*Gambusia affinis*, Günther, Cat., VI, 336, 1866; Girard, Mex. Bound. Surv., Ichth., 72, pl. 39, figs. 12–15, 1859; Jordan & Gilbert, Synopsis, 346, 1883; Evermann & Kendall, Bull. U. S. Fish Comm., XII, 1892 (1894.) 107, pl. 25, fig. 2.

*Gambusia patruelis*, Girard, Mex. Bound. Surv., Ichth., 72, pl. 39, figs. 1–7, 1859; Jordan & Gilbert, Synopsis, 346, 1883.

*Zygonectes melanops*, Jordan, Bull. Ill. Lab. Nat. Hist., 52, 1878.

### 1001. GAMBUSIA NOBILIS (Baird & Girard).

Head 2; depth 3½. D. 9; A. 10; scales 30–7. Teeth in broad bands. Interorbital space twice eye. First ray of dorsal twice as far from tip of snout as from base of caudal. Color light brown, punctate above by brown dots; breast orange; abdomen yellow; a faint dark band as broad as eye running along sides to root of caudal; a dusky band running down and back from eye across the cheek; a dark oblique band of dark points from gill opening to anal. Scales on upper part of body edged with brown. Length 2 inches. Southern Illinois to the Rio Grande region, our specimens collected by Woolman in Chihuahua River and representing *Gambusia senilis*. A very doubtful species, composed probably of overgrown examples of *Gambusia affinis*. (*nobilis*, noble.)

*Heterandria nobilis*, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1853, 390, Leona and Camanche Spring, Rio Grande Del Norte. (Coll. Clark.)

*Gambusia senilis*, Girard, Proc. Ac. Nat. Sci. Phila., 1859, 122, Chihuahua River, Mexico; D. 9; A. 10; size large. (Coll. John Potts.)

*Zygonectes inurus*,‡ Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 143, Cache Creek, southern Illinois. (Type, No. 29666. Coll. Forbes.) Jordan & Gilbert, Synopsis, 892, 1883.

*Gambusia nobilis*, Girard, Mex. Bound. Surv., Ichth., 71, pl. 39, fig. 8–11, 1859; Günther, Cat., VI, 335, 1866; Jordan & Gilbert, Synopsis, 346, 1883.

### 1002. GAMBUSIA NICARAGUENSIS, Günther.

Head 3⅜; depth 3⅓. D. 8; A. 10; scales 29–8. Snout broad, subspatulate, the lower jaw projecting beyond upper. Eye a little more than length of snout, 3 in head, and ⅗ width of interorbital space. In the female the origin of the dorsal is somewhat nearer tip of caudal than tip of snout, opposite last ray of anal; pectorals not quite reaching as far backward as the ventrals, which terminate immediately in front of anal; free portion of tail rather short; length of base of anal about half its distance from caudal. Brownish olive above, sometimes with a series of black dots along the rows of scales; dorsal and caudal fins crossed by series of black dots; middle of anal blackish. Lakes of Nicaragua. (Günther.)

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* *Gambusia gracilis* (Girard): Slender; anal larger than dorsal, and much anterior to it. Olive; dorsal and caudal with narrow blackish crossbars. Head 4¼; D. 6; A. 9. Matamoras.—*Girard.*

† *Zygonectes brachypterus*, Cope: "Base of the first dorsal ray behind the vertical line equally dividing the base of the anal; ventrals not reaching base of anal. Scales large. Head wide, with overhanging supercilia; interorbital width twice the diameter of the orbit, which enters the length of the head 2½ times. Color uniform olivaceous, the scales with brown edges; cheeks silvery; no spots on the head. Body stout. Head 4½; D. 7; A. 8; scales 30–9. Length 2 inches."—*Cope.*

‡ *Zygonectes inurus*, Jordan & Gilbert: Body rather short and deep. Head broad; eye as long as snout, 3½ in head, 2 in interorbital width; teeth in a band, the outer series scarcely enlarged. Fins short. Yellowish brown; scales darker edged; body without distinct longitudinal stripes or bars; belly golden; a very conspicuous jet-black spot just below the eye, and confluent with it in the adult; dorsal and caudal fins with series of black dots; caudal very large. Head 3⅔; depth 3½. D. 7; A. 9; scales 28–7. Length 2½ inches. Southern Illinois.

*Gambusia nicaraguensis*, GÜNTHER, Cat., VI, 336, 1866, lakes of Nicaragua. (Coll. Capt. Dow.)

### 1003. GAMBUSIA GRACILIS, Heckel.

Head 4; depth 3¾ to 4, deepest in female. D. 8; A. 8 or 9; V. 6; scales 29–7. Origin of dorsal fin nearly in middle of total length, but little behind that of anal fin in the female; anal process of male nearly twice as long as head, its extremity bent; pectorals reaching beyond root of ventrals; anal fin short in the female, the length of its base being at least ⅓ of its distance from the caudal. A dark band runs from the upper end of the gill opening to the caudal. (Heckel.) Orizaba, Mexico. (*gracilis*, slender.)

*Xiphophorus gracilis*, HECKEL, Sitzgsber. Akad. Wiss. Wien, I, 300, 1848, Orizaba, Mexico.
*Gambusia gracilis*, GÜNTHER, Cat., VI, 336, 1866; JORDAN & GILBERT, Synopsis, 346, 1883.

### 1004. GAMBUSIA EPISCOPI, Steindachner.

Head 3½ to 3¾; depth, male, 4; female, 3⅖ to 3¾; eye 3 in head. D. 8 or 9; A. 10; scales 28–7. Body elongate, the males slenderest; interorbital width 2; snout broad, depressed, the lower jaw prominent; outer teeth a little stronger; insertion of dorsal in female about in middle of length; pectoral reaching ventral; anal longer than head in males. Body in both sexes with numerous dark cross bands, which posteriorly reach the belly, but which are wanting before the dorsal in the females; sometimes a row of dark spots from pectoral to caudal; bands sometimes faint, replaced by a dark blotch on middle of sides below front of dorsal; edges of scales with dark dots; usually a black blotch on middle of base of anal; rows of dark spots usually present on dorsal and anal. Length 1⅔ inches. Ditches on the isthmus of Panama, at Obispo Station, (hence the name *Obispo* = *Episcopus* = bishop.)

*Gambusia episcopi*, STEINDACHNER, Ichth. Beiträge, VI, 9, 1878, Obispo, near Panama.

### 1005. GAMBUSIA PICTURATA, Poey.

A male specimen imperfectly described. Depth equal to length of head, about 5 times in total length with caudal; eye occupying second third of head. Dorsal beginning a little before middle of length; anal much farther forward, its longest rays ⅓ length of body; ventrals very small; caudal rounded; whole body black, marbled with yellow; golden in life. Iris silvery, with a dark lengthwise band. Length 1⅗ inches. Cuba. (Poey); not seen by us. (*picturatus*, pictured.)

*Gambusia picturata*, POEY, Synopsis, 410, 1868, San Diego de los Baños, Cuba.

## 311. BELONESOX, Kner.

*Belonesox*, Kner, Sitzgsber. Akad. Wiss. Wien, 1860, xl, 419, (*belizanus*).

Cleft of mouth much developed laterally, the jaw bones being much produced, making a beak like that of *Labidesthes.* Premaxillaries forming together an elongate triangular plate, but not anchylosed together. Mandible long, somewhat prominent; each jaw with a broad band of cardiform teeth. Scales small. Anal in advance of dorsal, modified in the male into an intromittent organ. Branchiostegals 6. Intestinal canal short. Carnivorous. Mexico. (*Belone*; *Esox.*)

### 1006. BELONESOX BELIZANUS, Kner.

Head 2⅔ to 3; depth 5 to 6. B. 6; D. 9; A. 10 or 11; V. 6; scales 56 to 63–18. Upper surface of the premaxillary plate as long as postorbital part of head. Length of base of dorsal more than ½ its distance from caudal in males, and ½ in females. Brownish olive above; sides with longitudinal series of black dots; a round black spot on the root of the caudal. Anal process of male composed of 3 rays, and ⅔ as long as head. Southern Mexico, Honduras, and Guatemala; a curious fish, reaching a considerable size, the females 7 inches, the male 4 in length. (*belizanus*, from Belize.)

*Belonesox belizanus*, Kner, Sitzgsber. Akad. Wiss. Wien, 1860, 419, with figure, Belize; Günther, Cat., vi, 333, 1866; Jordan & Gilbert, Synopsis, 345, 1883.

## 312. ANABLEPS (Artedi) Bloch.

(Four-eyed Fishes.)

*Anableps* (Artedi) Bloch, Ichthyologia, viii, 7, 1795, (*tetrophthalmus* = *anableps*).

Body elongate, depressed anteriorly and compressed posteriorly. Head broad and depressed, with the supraorbital part very much raised. Cleft of mouth horizontal, of moderate width, the mandible being short, having, however, its bones firmly united; upper jaw protractile. Both jaws armed with a band of villiform teeth, those of the outer series being largest and somewhat movable. The integuments of the eye are divided into an upper and lower portion by a dark-colored transverse band of the conjunctiva; also the pupil is incompletely divided into 2 by a pair of lobes projecting from each side of the iris. Nasal opening produced into a short tubule depending from each side of the mouth. Scales rather small or of moderate size. Dorsal and anal fins short, the former behind the latter; anal fin of male modified into a thick and long scaly conical organ with an orifice at its extremity. Intestinal tract but little convoluted. Gill membranes of both sides united for a short distance, and not attached to the isthmus. Vertebræ about 46. Fresh waters of South America, one species ranging northward to southern Mexico; extraordinary fishes, swimming at the surface of the water and feeding on insects, the eye divided by a horizontal partition into a lower portion for water use, and a portion for seeing in the air. (*αναβλέπω*, to look upward.)

### 1007. ANABLEPS DOVII, Gill.

Head 4. D. 9; A. 10; scales 65 to 70, 49 before dorsal. Vertebræ 24 + 22. Flat portion of interorbital space as broad as a scale. Back and sides of the body blackish brown, with a well-defined, broad, golden band along sides from the axil of the pectoral to the base of the caudal; fins pale. Waters of Central America, from Chiapas to the Isthmus of Panama. (Günther.) (Named for Captain John M. Dow, discoverer of the species at Panama.)

*Anableps dovii*, GILL, Proc. Ac. Nat. Sci. Phila., 1864, 4, Panama; GÜNTHER, Cat., VI, 338, 1866.

## 313. GOODEA, Jordan.

*Goodea*, JORDAN, Proc. U. S. Nat. Mus., 1879, 299, (*atripinnis*).

Form of *Fundulus*, but with the intestinal canal elongate, the dentary bones loosely joined, and the teeth slender, movable, tricuspid, attached in a single series on the outer edge of the jaws, not closely set, a band of villiform teeth behind them. Fins small, the dorsal and anal similar, the dorsal slightly in advance of anal. No spines. Scales moderate. Mud-eating, the intestinal canal elongate. Anal fin in male probably not modified as an intromittent organ. Mexico. (Named for Professor George Brown Goode, director of the United States National Museum, and one of the most scholarly of modern writers on fishes.)

### 1008. GOODEA ATRIPINNIS, Jordan.

Head 4; depth 4; eye 3½. D. 12; A. 13; scales 37 to 40–13. Body oblong, compressed, the back nearly straight, the caudal peduncle deep. Head short, broad, depressed. Mouth small. Lower jaw projecting. Teeth loosely inserted, not close together. Eye moderate, directed partly downward, a little more than half width of interorbital space. Humeral scale somewhat enlarged. Fins small; dorsal slightly in advance of anal; caudal small. Intestinal canal elongate, convolute, (and filled with mud in the types). Bluish above, sides nearly plain; a silvery streak along each row of scales; vertical fins chiefly black, especially on the distal half. Length 4 inches. Guanajuato, Mexico, from a salt lake in a volcanic basin; a singular little fish, differing from all the other herbivorous Cyprinodonts in the tricuspid teeth, and apparently, also, in not having the anal fin modified. (*ater*, black; *pinna*, fin.)

*Goodea atripinnis*, JORDAN, Proc. U. S. Nat. Mus., 1879, 299, Leon in Guanajuato, Mexico. (Type, No. 23137. Coll. Prof. Dugès.) JORDAN & GILBERT, Synopsis, 348, 1883.

## 314. PLATYPŒCILUS, Günther.

*Platypœcilus*, GÜNTHER, Cat., VI, 350, 1866, (*maculatus*).

Small fishes, with the body deep, the origin of the anal fin distinctly behind that of the dorsal, both fins being short; otherwise essentially as in *Heterandria*. (*πλατύς*, broad; *ποικίλυς*, *Pœcilus* = *Pœcilia*.)

*a.* Body deep, the depth 2⅓ in length; side of body with a black spot. MACULATUS, 1009.

*aa.* Body moderately elongate, the depth 3½ in length; chin with a black line; dorsal with a black blotch at base. MENTALIS, 1010.

### 1009. PLATYPŒCILUS MACULATUS, Günther.

Head 3½; depth 2⅓; eye longer than snout, 3 in head. D. 10; A. 9; scales 25–8. Body much compressed and elevated. Interorbital width ⅔ length of head. Dorsal fin rather large; anal small; pectoral reaching beyond root of ventral; caudal peduncle short and deep. Olivaceous; a roundish black spot on middle of root of caudal; a black spot on middle of side of body; dorsal often densely spotted with black; margins of anal and caudal black. Length 1½ inches. Mexico; known from two female specimens. (Günther.) (*maculatus*, spotted.)

*Platypœcilus maculatus*, GÜNTHER, Cat., VI, 350, 1866, Mexico; (Coll. Sallé); JORDAN & GILBERT, Synopsis, 348, 1883.

### 1010. PLATYPŒCILUS MENTALIS, Gill.

Head 3½; depth 3½; eye considerably longer than snout, 3 in head. Body regularly compressed backward and moderately elevated, its greatest depth being in advance of dorsal; head less compressed than the body; the width of the interorbital space less than ½ entire length of head. Dorsal fin moderate, higher than long, its origin about midway between tip of snout and middle of caudal; anal small, its origin opposite middle of dorsal; caudal fin round, equal to length of head, its depth at base ¾ length of head; pectoral extending considerably beyond root of ventral; ventral not reaching anal. Color, a uniform brownish olive, with no caudal spot; a linear band crossing the chin parallel with the lip; the dorsal with a deep, black, band-like spot near the base crossing the anterior half. Brooks on Atlantic side of Isthmus of Panama. (Gill); not seen by us. (*mentalis*, having a conspicuous chin, *mentum*.)

*Platypœcilus mentalis*, GILL, Proc. Ac. Nat. Sci. Phila., 1876, 335, Isthmus of Panama.

## 315. HETERANDRIA, Agassiz.

*Heterandria*, AGASSIZ, Amer Journ. Sci. Arts., 1853, 135,* (*formosus*; *holbrooki*).
*Girardinus*, POEY, Memorias, I, 383, 1855,† (*metallicus*).

Body rather slender; mouth very small, the lower jaw very short, its bones not united; snout short; both jaws with a single series of slender, movable, pointed teeth; scales rather large; anal fin more or less in advance of dorsal, in the male modified into an intromittent organ; intestinal canal elongate. Very small, viviparous, mud-eating fishes, among

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*The genus *Heterandria* was proposed by Agassiz (Amer. Journ. Sci. Arts, XVI, 135) in 1853, to include certain Cyprinodonts which have the anal fin in the male modified. The two species (*holbrooki* and *formosa*) possessed by Agassiz (but not named until 1859), belong to different genera, which correspond respectively to Poey's *Gambusia* and *Girardinus*. These generic names first occur in the Memorias sobre la Historia Natural de la Isla de Cuba (I, p. 390). The date assigned to their publication by Girard (Proc. Ac. Nat. Sci. Phila., 1859) is the year 1851, which would give each two years priority over *Heterandria*. This is, in fact, the date given on the title page of the *Memorias*, but the volume was issued in parts, its publication extending over several years, and the issue of the part containing *Girardinus* and *Gambusia* could not have been earlier than 1855. This is evident, as papers written in 1854 are printed in the text before it. In place either of *Gambusia* or *Girardinus* the name *Heterandria* must therefore be used. We have elsewhere restricted it to the type of *Girardinus*, regarding *Heterandria formosa*, Agassiz, as its type. This arrangement is in accordance with the wishes of Professor Poey, to whom we are indebted for the suggestion that *Heterandria* is prior to *Girardinus*.

†These species were first named by Girard in 1859, after Agassiz's manuscript. Agassiz defined the genus *Heterandria* with *Chologaster*, *Zygonectes*, and *Melanura* in 1853, in a letter to Prof. J. D. Dana, published in the American Journal as above, but in this paper the species were not named.

the smallest vertebrate animals known, found in swamps and ditches of the warmer parts of America. In habits, the species are similar to those of *Gambusia*, and some of them strongly resemble the latter genus. The small, weak mouth and feeble dentition will, however, distinguish the species of *Heterandria*. Mexico and the southern United States to Central America and the West Indies. (*ἕτερος*, different; *ἀνήρ*, male.)

- *a.* Anal rays 11; scales 30 to 35.
  - *b.* Scales in 35 lengthwise series; dorsal rays 9; a round black spot on side opposite vent. UNINOTATA, 1011.
  - *bb.* Scales in 30 transverse series; dorsal rays 9; body reticulated with brown, and with silvery crossbars; a black spot at posterior base of dorsal. METALLICA, 1012.
- *aa.* Anal rays 6 to 9; dorsal rays 7 or 8; scales 24 to 28.
  - *c.* Sides with a jet-black lateral streak, crossed by 6 or 8 black vertical bars; bases of dorsal, caudal, and anal each with a black spot; size very small. FORMOSA, 1013.
  - *cc.* Sides without distinct black crossbars across a lateral band.
    - *d.* Sides with a row of about 7 round blackish spots of the size of the eye, along middle of side; a black line along tail above and below; tail with faint cross bands. PLEUROSPILUS, 1014.
    - *dd.* Sides with a rather faint dark lateral band.
      - *e.* Dorsal with a black blotch on its posterior rays; a dark line along tail above and below, and usually silvery crossbars on its side; 2 or 3 irregular reticulated black spots above lateral band. VERSICOLOR, 1015.
      - *ee.* Dorsal without dark blotch, the fins all plain; a dark line along lower edge of tail; size rather large. OCCIDENTALIS, 1016.

### 1011. HETERANDRIA UNINOTATA (Poey).

Head 5½ to 6; depth 5 in total length (with caudal). B. 5; D. 9; A. 11; scales 35. Eye longer than the snout, 3¾ in head. Dorsal fin of female inserted at middle of total length; ventrals reaching the vent. Anal process of the male very long, equal in length to its distance from the end of the snout, terminating in a clasper. Greenish brown, with a large round spot on the side, opposite the vent. Streams of Cuba. (Poey); not seen by us. (*uninotatus*, with one spot.)

*Girardinus uninotatus*, POEY, Memorias, II, 309, 1861, Rio Tacotaco, Cuba; GÜNTHER, Cat., VI, 351, 1866.

### 1012. HETERANDRIA METALLICA (Poey).

Head 4⅓; depth 4¼. B. 5; D. 9; A. 11; V. 6; scales 30; vertebræ 13+20. Origin of dorsal in female nearer tip of caudal, and opposite third or fourth anal ray; in the male it is nearer tip of snout. Anal process of the male nearly twice as long as head, with recurved spines, and a clasper at its extremity. Pectoral and ventral fins short. Free portion of the tail moderately deep. Greenish, reticulated with brown, with silvery cross bands; a black spot at the posterior part of base of dorsal. (Poey.) Streams of Cuba. (*metallicus*, like metal.)

*Girardinus metallicus*, POEY, Memorias, I, 387, pl. 31, figs. 8-11, 1855, Cuba; GÜNTHER, Cat., VI, 351, 1866.

### 1013. HETERANDRIA FORMOSA, Agassiz.

Head 3½ to 3⅔; depth 3¾ to 4; eye 3. D. 7; A. 6 to 9; scales 24 to 28. Body short, slightly compressed. Snout very short, about ⅔ eye. Mouth terminal, slightly oblique; lower jaw slightly projecting; jaws each with a series of small, pointed, movable teeth; gill membranes united. Dorsal fin short, on posterior part of body, its origin above, on a vertical from middle of anal, and about midway between end of snout and tip of caudal fin; anal in males considerably in advance of dorsal, and transformed into an intromittent organ; caudal fin rather long, about 5 in body, slightly dusky at its tip. Color in spirits, brownish olive; a dark band about as wide as eye from mouth through eye and along middle of the side, terminating in a black spot at base of caudal; band crossed by 6 to 9 brownish-black vertical streaks which become fainter with age, the anterior ones the less prominent; these markings made up of small dark dots; a black spot on base of dorsal and anal fins. Length, female 1 inch, male ¾ inch. South Carolina to Florida; exceedingly abundant in the black water of swamps and in ditches, in company with *Gambusia affinis*; said to be the smallest known fish. (*formosus*, comely.)

*Heterandria formosa*, Agassiz MS, 1853; Girard, Proc. Ac. Nat. Sci. Phila., 1859, 62, Charleston, South Carolina; Palatka, Florida.

*Girardinus formosus*, Günther, Cat., vi, 354, 1866; Jordan & Gilbert, Synopsis, 349, 1883; Jordan & Gilbert, Proc. U. S. Nat. Mus., 1884, 236.

### 1014. HETERANDRIA PLEUROSPILUS (Günther).

Head 4; depth 3⅘. D. 8; A. 9; V. 6; scales 28–8. Eye more than length of snout, 3 in head, and 1½ in interorbital space, which is slightly concave. In the female the origin of dorsal is at middle of total length, and conspicuously behind that of anal; caudal fin large, longer than head, subtruncate behind; free portion of tail somewhat elongate, length of base of anal ⅓ of its distance from caudal; pectoral fin not quite as long as head and not extending so far backward as the ventral fins, which reach vent; in the male the origin of dorsal is somewhat nearer tip of caudal than that of snout; the anal process quite straight, nearly twice as long as head, and ending in a simple tapering point; caudal very short. Reddish olive; a series of 6 or 7 round blackish spots, each about the size of the eye, along the middle of the side; a black line along the base of the anal fin and on lower and upper margins of the tail; caudal fin with 2 indistinct dark cross bands. Females 2 inches long, males 1. Guatemala. (Günther.) (*πλεῦρον*, side; *σπῖλος*, spot.)

*Girardinus pleurospilus*, Günther, Cat., vi, 353, 1866, Lake of Dueñas. (Coll. Salvin.)

### 1015. HETERANDRIA VERSICOLOR (Günther).

Head 3¾; depth 3⅗. D. 8; A. 8; V. 6; scales 27–8. Eye longer than snout, 2½ in head, and 1¼ in interorbital space, which is nearly flat. In the female the origin of dorsal is nearer tip of snout than tip of caudal and opposite second ray of anal; caudal moderate, as long as head, rounded behind; free portion of tail somewhat elongate; length of base of anal ⅖ its distance from caudal; pectoral shorter than head, extending somewhat beyond root of ventrals, which reach vent. Reddish olive above, sometimes with indistinct silvery crossbars on the side of the tail; an indistinct dark band along middle of side, and above it 2 or 3 reticulated black spots, their number and situation being variable, even on the two sides of the same individual; a black line along the lower and upper margins of the tail: a blackish blotch on the posterior rays of the dorsal fin. San Domingo. (Günther.) Known from 2 females; not seen by us. (*versicolor*, variegated.)

*Girardinus versicolor*, Günther, Cat., vi, 352, 1866, San Domingo. (Coll. Mr. Cuming.)

### 1016. HETERANDRIA OCCIDENTALIS, Baird & Girard.

Head 3½; depth 4 to 4⅓. D. 7 or 8; A. 9 or 10; scales 29–8. Body deep, elevated in front of dorsal. Insertion of dorsal nearer base of caudal than tip of snout, slightly in advance of anal. Brownish above, dotted with black; silvery below, with a black lateral stripe, as broad as eye, from shoulder to caudal; a narrow black line along lower margin of tail; fins unicolor, without spot or blotch. Length 2½ inches. Gila Basin, Arizona, and basins of Yaqui and Sonora rivers, Sonora; locally abundant in springs and ditches; our specimens sent from Tucson by William W. Price and Herbert Brown. This species looks like a *Gambusia*, but has a much smaller mouth. It seems nearer allied to *Pœcilia* than to the typical species of *Heterandria*. (*occidentalis*, western.)

*Heterandria occidentalis*, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1853, 390, Rio Santa Cruz, near Tucson, Arizona. (Coll. Clark.)

*Girardinus sonoriensis*, Girard, Proc. Ac. Nat. Sci. Phila., 1859, 120, San Bernardino Creek, a tributary of Rio Yaqui, in Sonora; Günther, Cat., vi, 355, 1866.

*Girardinus occidentalis*, Günther, Cat., vi, 354, 1866; Jordan & Gilbert, Synopsis, 349, 1883.

## 316. LEBISTES, De Filippi.

*Lebistes*, De Filippi, Arch. Zool. Anat., etc., i, 1862, 69.

Cleft of the mouth small, with the lower jaw projecting beyond the upper; both jaws with a narrow band of very small teeth, those in the outer series being the largest. Scales of moderate size. Dorsal and anal fins short; anal in advance of the dorsal, with the second and third rays much thickened and elongate in both sexes. Second ventral longest, ending in a hook in the females. Island of Barbadoes. We know this genus only from Dr. Günther's abridgment of De Filippi's account. With Dr. Günther,* we doubt the correctness of the sexual characters assigned. (*λεβίας*, a small fish, from *λέβης*, a kettle; a pot fish.)

### 1017. LEBISTES PŒCILIODES, De Filippi.

D. 9; A. 7; V. 6; scales 34–8. Barbadoes. Length 1½ inches. (Günther.) (*Pœcilia*; *εἶδος*, likeness.)

*Lebistes pœciliodes*, De Filippi, Arch. Zool. Anat., i, 1862, 69, Barbadoes; Günther, Cat., vi, 356, 1866.

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* "If the characters assigned to this very doubtful genus are correct, it differs in a very extraordinary manner from the other fish of this family, in which sexual differences are observed. From an inspection of the figure, we should have considered the specimen to be a male; but Prof. De Filippi says distinctly that the peculiar anal fin is found in the female as well as in the male."—*Günther.*

## 317. ACROPŒCILIA, Hilgendorf.

*Acropœcilia*, HILGENDORF, Sitzungsberichte Naturf. Freunde, 1889, 52, (*tridens*).

Teeth in the inner series of both jaws trifid; otherwise essentially as in *Pœcilia*. Appearance of *Pœcilia*, the dorsal very short, the mandible weak, the dentary bones loosely articulated, the intestines with 4 convolutions. One species known, but very likely others now referred to *Pœcilia* will be found to belong here, and the two genera may prove to be inseparable. (*ἄκρος*, sharp; *Pœcilia*.)

### 1018. ACROPŒCILIA TRIDENS (Hilgendorf).

Head 4; depth 3; eye 3, 1¾ in interorbital space, $\frac{5}{4}$ length of snout. D. 7; A. 8; scales 27–9. Teeth in front row much elongate, band-like, with broadened, truncate tips; teeth of the 2 posterior series much smaller, their cutting edge trifid, the middle lobe projecting beyond the others; teeth similar in the 2 jaws; tips of all the teeth brown. Insertion of dorsal in female a little farther from gill opening than from convexity of caudal, the distance equal in males; dorsal somewhat behind anal in females, much behind in males; dorsal higher than body in males, half as high in females; pectoral 1⅕ in head; lower jaw little projecting. Coloration olivaceous, with black dots everywhere except on belly and ventrals; a black network surrounding the scales, finest on the tail; young with distinct dark cross bands, and a dark vertebral streak; opercle black; a basal band on the dorsal; in the young and the female a large black spot on posterior margin of the fin; caudal rarely with traces of vertical bands; belly dirty silvery. Length 2 inches; male 1½ inches. Port au Prince, Haiti. (Hilgendorf.) (*tridens*, three-toothed.)

*Pœcilia* (*Acropœcilia*) *tridens*, HILGENDORF, Sitzgsber. Naturf. Freunde, 1889, 52, Port au Prince.

## 318. PŒCILIA, Bloch & Schneider.

*Pœcilia*, BLOCH & SCHNEIDER, Systema Ichthyologia, 452, 1801, (*vivipara*).
*Limia*, POEY, Memorias, I, 388, 1855, (*cubensis*).

Body oblong, often rather deep; mouth small, transverse, with weak jaws; teeth small, in narrow bands, the outer series in each jaw being usually enlarged, curved, movable, and with brown tips; lower jaw not prominent, its bones movable. Scales large. Dorsal fin rather small, of 7 to 11 rays; anal fin short, in female nearly opposite dorsal in males advanced and modified into a sword-shaped intromittent organ. Vertebræ about 28. Intestine long. Species mud-eating and viviparous. This genus differs from *Mollienesia* only in the smaller size of the dorsal, which has usually 9 or 10 rays and is nearly opposite the anal in the female, but behind it in the male. The numerous species inhabit the West Indies, Mexico, and South America. They are not well known and, having never been critically compared, it is impossible to form an analytical key to them on the basis of our present knowledge. Some of them may prove to belong to *Heterandria*, and others to *Acropœcilia*, or to other groups. (*ποικίλος*, variegated, but the species are duller in color than are those of related genera.)

*a.* Scales very large, 23 to 25 in a lengthwise series; coloration plain; dorsal and anal dotted.
  *b.* Dorsal rays 7; anal rays 7; coloration plain, the fins dotted. VIVIPARA, 1019.
  *bb.* Dorsal rays 9; anal rays 8. BUTLERI; GILLI, 1020; 1021.
*aa.* Scales moderate, 28 to 32 in a lengthwise series.
  *c.* Base of caudal with a black ocellus. PAVONINA, 1022.
  *cc.* Base of caudal without distinct black ocellus.
    *d.* Dorsal and anal each with 10 or 11 rays; scales 30 to 32–10; depth 3 to 3⅓ in length; sides with 2 rows of black dots. VITTATA, 1023.
    *dd.* Dorsal with 7 to 11 rays; anal rays 6 to 9.
      *e.* Body rather robust, the depth in adult more than ¼ the length. MEXICANA; THERMALIS; CHISOYENSIS; PETENENSIS; SPHENOPS; DOVII; COUCHIANA; BOUCARDI; VANDEPOLLI; DOMINICENSIS; MELANOGASTER; SPILURUS, 1024–1035.
      *ee.* Body rather elongate, the depth in adult not more than ¼ the length, ELONGATA; PRESIDIONIS, 1036; 1037.

### 1019. PŒCILIA VIVIPARA, Bloch & Schneider.

Depth 3; B. 5; D. 7; A. 7; scales 24; vertebræ 15 + 13. Eye 3 in head, or 2 in interorbital width. Greenish, each scale with the margin brownish; dorsal fin with a small blackish spot in the middle; caudal with a black spot near the base of the upper and lower rays. Brazil; Guiana; Martinique. (Günther); not seen by us; a species long known, but never well described. (*viviparus*, bringing forth living young.)

*Pœcilia vivipara*, BLOCH & SCHNEIDER,* Syst. Ichthyol., 452, pl. 86, fig. 2, 1801, Surinam; GÜNTHER, Cat., VI, 345, 1866.

*Pœcilia surinamensis*, VALENCIENNES, Humboldt Observ. Zoöl., II, 158, 1817, Surinam.

*Pœcilia schneideri*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVIII, 135, 1846, Surinam.

### 1020. PŒCILIA BUTLERI, Jordan.

Head 3⅕ to 3⅔; depth 2¾ (adult) to 3⅓ (young). D. 9; A. 6 to 8; scales 24 to 26–9. Origin of dorsal midway between base of caudal and front of eye, and over tenth scale of lateral line; fins moderate, longest ray of dorsal about as long as head without snout; caudal scaly at base; caudal peduncle compressed and deep. Color uniform olive, the young with faint, dark cross shades; caudal with a few black spots; dorsal with numerous round, black spots in both sexes. Allied to *Pœcilia dovii*, but with deeper body and larger scales. Length of adult 2 inches.

Fresh specimens recently obtained by the Hopkins Expedition from the Rio Presidio are described as follows: Head 3½; depth 3⅓. D. 9; A. 6; scales 26–9. Eye equal to snout, 3 in head; interorbital width 2. Pectoral 1¼ in head; caudal 1 in head; longest dorsal ray in males 1¼ in head, in females 1⅔. Body deep and compressed, the form as in *Adinia*, the straight anterior profile rising considerably to front of dorsal. Dorsal small, even in the male, inserted over or somewhat before anal, much behind anal in female. Teeth in two series, well separated, the inner series smaller and more close-set, not trifid; caudal peduncle very deep, the fin broad. Males larger than females, equally numerous, and with higher fins, as in *Mollienesia*. Color of males green, with a pale-blue spot on each scale, surrounded by bronze shades; no dark crossbars, except in young; dorsal and anal pale orange, with many small, round, black dots; lower fins pale. Female similar but paler; no cross bands; a faint dark spot behind pectoral; lower fins bright orange; caudal nearly plain; dorsal spotted as in the male, but less profusely. Length 2 to 3 inches. Very common in the clear streams of Sinaloa, especially in Rio Presidio, descending to brackish water. (Named for Amos W. Butler, of Brookville, Indiana, a well-known ornithologist who has collected fishes in Mexico.)

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* In the figure of Bloch & Schneider the body is represented as marked by broad cross bands of dark brown.

*Pœcilia butleri*, JORDAN, Proc. U. S. Nat. Mus., 1888, 330, Rio Presidio, near Mazatlan. (Type, No. 37158. Coll. Alphonse Forrer.)

### 1021. PŒCILIA GILLII (Kner & Steindachner).

Head 4 to 5 in total length; depth a little greater. D. 9; A. 8 or 9; scales 25–8. Eye 3 in head; interorbital width 1 to 1½ in head. Dorsal inserted near middle of body, opposite anal in females. Young brown, with faint vertical bands; older individuals with dark edges to the scales; dorsal punctate; young often with a black spot at base of last anal rays; caudal plain or with black points. Length 2 inches. Rio Chagres. (Kner & Steindachner); not seen by us. (Named for Theodore Gill.)

*Xiphophorus gillii*, KNER & STEINDACHNER, Abh. Bayer. Akad. for 1864, 28, 1866, Rio Chagres.

### 1022. PŒCILIA PAVONINA (Poey).

Female brownish green, with an ocellate spot near the base of caudal on the lower middle part of the fin; this spot black, surrounded by white or reddish; body with brown spots. Havana. (Poey.) Fins and scales undescribed. (*pavoninus*, like a peacock.)

*Limia pavonina*, POEY, Enumeratio, 142, 1875, Havana. (Coll. Poey.)

### 1023. PŒCILIA VITTATA, Guichenot.

(FANGUITO; GUAJICA.)

Head 4; depth 2⅘. D. 10 or 11; A. 10 or 11; scales 30–10; vertebræ 13 + 16. Eye longer than snout, 3 in head. Origin of dorsal nearer occiput than root of caudal, and, in the female, in advance of that of anal. Dorsal and anal of moderate size; in the male the origin of the anal is much nearer to end of snout than root of caudal and before extremity of pectoral, its longest ray provided with an adipose apical appendage; tail moderately elongate, its least depth being not much less than the length of the head. Two series of black dots along each side of the body; dorsal and caudal with irregular black spots. Cuba. (Poey.) (*vittatus*, striped.)

*Pœcilia vittata*, GUICHENOT, in Ramon de la Sagra, Hist. Nat. Cuba, Poiss., 146, pl. 5, fig. 1, 1850, Cuba; GÜNTHER, Cat., VI, 339, 1866.

*Limia cubensis*,* POEY, Memorias, I, 388, 1855, Havana.

*Pœcilia cubensis*, GÜNTHER, VI, 340, 1866.

### 1024. PŒCILIA MEXICANA, Steindachner.

Head 4; depth 3⅓; eye in adult nearly or quite equal to snout, 3½ in head, and half width of interorbital space; larger in young. D. 10; A.

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* According to Poey *cubensis* has the eye 1¼ in snout, 3 in head; *vittata*, eye 1½ in snout, 3½ in head. In later papers he has regarded the two as identical.

9; scales 28–9 or 10. Origin of dorsal midway between root of caudal and occiput, over twelfth scale of the lateral series. Origin of dorsal slightly in advance of that of anal; dorsal fin rather small; anal very small; basal half of the caudal scaly. Tail compressed, high, its least depth being equal to, or rather more than, length of head without snout Eight longitudinal series of scales on each side of the tail. Brownish green; each scale of the 4 middle series of the trunk with a small central black spot; dorsal with numerous round blackish spots; caudal with an indistinct whitish cross-band near its hind margin. Males comparatively scarce; they want the black spots on the sides, and have the anal fin transformed into an intromittent organ. Southern Mexico and Central America; Chiapas, Dueñas, Vera Paz, and Amatitlan. (Günther.)

*Pœcilia mexicana*, STEINDACHNER, Sitzber. Akad. Wiss. Wien, 1863, 178, Southern Mexico; GÜNTHER, Cat., VI, 340, 1866.

### 1025. PŒCILIA THERMALIS, Steindachner.

Head 3¾; depth 3¾. D. 9 or 10; A. 8 or 9; scales 30–9. Width of interorbital space equal to distance between front margin of orbit and gill opening; the eye a little longer than snout, 3⅓ in head, a little more than half the interorbital space. Origin of dorsal midway between root of caudal and occiput, over twelfth scale of the lateral series; origin of anal opposite third ray of dorsal in the female; dorsal fin of moderate size; anal small; caudal scaly at the base only. Tail compressed, moderately elongate, its least depth being somewhat less than the length of the head without snout. Seven longitudinal series of scales on each side of the tail. Greenish; a faint darker streak along each series of scales; frequently a round blackish spot in the middle of the side in females. Male with the dorsal fin elevated, and the longest ray at least as long as the head without snout; this fin ornamented with large, ovate black spots, occupying the lower half of the fin, and sometimes confluent into one large patch. Anal fin modified into an intromittent organ, and advanced to between the ventrals and in front of the dorsal. Tail strongly compressed, and comparatively rather higher than in the female. Interradial membrane of the caudal fin with oblong black spots, nothing of which is visible in the female. Warm springs in Central America. (Günther.) (*thermalis*, pertaining to heat.)

*Pœcilia thermalis*, STEINDACHNER, Sitzber. Akad. Wiss. Wien, 1863, 181, warm springs in Central America; GÜNTHER, Cat., VI, 341, 1866.

*Gambusia** *modesta*, TROSCHEL, Müller's Reise in Mexico, III, 639, 1865, Mexico; no locality given.

### 1026. PŒCILIA CHISOYENSIS, Günther.

Head 4⅓; depth 3⅓. Eye equal to snout, 3½ in head, and more than half width of interorbital space. D. 9 or 10; scales 29–9. Free portion of tail elevated, its least depth ⅔ its own length, and more than length of head without snout. Origin of dorsal fin nearer occiput than to root of caudal, behind that of the anal, above the twelfth scale of the lateral series; dorsal fin higher than long, its longest ray shorter than head; enlarged anal ray without terminal appendage. Eight longitudinal series of scales on each side of the tail. Caudal rather short, its basal half covered with scales. Uniform greenish, with golden reflections; dorsal and caudal black. Length 3½ inches. Rio Chisoy, Vera Paz. (Günther.)

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* *Gambusia modesta*: D. 10; A. 9; P. 16. Length of type (male) 1¾ inches; depth 4½ in total length; dorsal inserted over last rays of anal, as high as the body below it; anal equally high; pectorals reaching end of base of anal; caudal rounded. Brown, with irregular dark spots on back; no net-like markings formed by edges of scales.—*Troschel.*

*Pœcilia chisoyensis*, GÜNTHER, Cat., VI, 342, Rio Chisoy, Vera Paz, in basin of Rio Usumacinta. (Coll. Godman & Salvin.)

### 1027. PŒCILIA PETENENSIS, Günther.

Head 4 in male, 5 in female; depth 3¼ in male, 4⅕ in female. D. 11; A. 8; scales 29–30–8 or 9; vertebræ 16 + 14. Eye equal to snout, 3½ in head, somewhat more than half interorbital width. Origin of dorsal fin farther from root of caudal than from occiput, over eleventh or twelfth scale of lateral series; origin of anal opposite fourth ray of dorsal fin (in the female); dorsal fin of moderate size; anal rather small, but pointed; caudal scaly on its basal third; free portion of tail compressed, rather high, its least depth half its length, equal to length of head without snout. Seven longitudinal series of scales on each side of the tail. Male with the dorsal fin somewhat elevated, the longest ray being rather longer than the head; anal fin modified into an intromittent organ, and advanced to between the ventrals, in front of the dorsal. Tail strongly compressed, and much higher than in the female, its least depth being equal to the length of the head. Greenish, each scale with a black vertical spot; dorsal and basal half of the anal irregularly and finely marbled with brown. Length 6 inches. Lake Peten. (Günther.)

*Pœcilia petenensis*, GÜNTHER, Cat., VI, 342, 1866, Lake Peten in Guatemala. (Coll. Salvin.)

### 1028. PŒCILIA SPHENOPS, Cuvier & Valenciennes.

Head 3⅜; depth 3⅓. D. 9; A. 8; scales 28–8. Eye equal to snout, 3½ in head, a little more than half interorbital width. Origin of dorsal midway between root of caudal and occiput, over thirteenth scale of lateral series; origin of anal opposite that of dorsal (in the female); dorsal of moderate size anal small; caudal scaly at the base only. Tail compressed, rather high, its least depth equal to length of head without snout. Eight longitudinal series of scales on each side of the tail. Greenish, each scale darker at the base; back of the tail with narrow, irregular, silvery crossbars. Male with the dorsal fin somewhat elevated, but the longest ray scarcely as long as the head without snout; this fin is ornamented with round, black spots; anal fin modified into an intromittent organ, and advanced to between the ventrals. Tail strongly compressed, and comparatively higher than in the female. Caudal fin with oblong black spots on the interradial membrane of the basal half, with a broad, whitish, posterior marginal band, and narrow black edge. The female has the dorsal only spotted with black. Length 3 inches. Vera Cruz, Mexico. (Günther.) (σφήν, wedge; ὤψ, face; "museau en coin," peaked-face.)

*Pœcilia sphenops*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVIII, 130, 1846, Vera Cruz; GÜNTHER, Cat., VI, 343, 1866.

### 1029. PŒCILIA DOVII, Günther.

Head $3\frac{3}{5}$; depth $3\frac{2}{5}$. D. 9; A. 8; scales 26 to 29–9. Width of interorbital space rather less than distance between front margin of eye and gill opening. Eye somewhat more than length of snout, $3\frac{1}{2}$ in head, and rather more than half width of interorbital space. Origin of dorsal fin midway between root of caudal and occiput, over twelfth scale of lateral series; origin of anal opposite the second or third ray of the dorsal (in the female); dorsal fin of moderate size; anal small; caudal scaly on its basal third. Tail compressed, rather high, its least depth equal to length of head without snout. Seven longitudinal series of scales on each side of the tail. Uniform brownish green on the head and body; male with the dorsal fin slightly elevated, but the longest ray is scarcely as long as the head without snout; this fin is ornamented with small, round, black spots. Anal fin modified into an intromittent organ, and advanced to between the ventrals and in front of the dorsal. Tail strongly compressed, but not higher than in the female. Caudal fin with minute black spots on the interradial membrane; back of tail sometimes with indistinct, narrow, dark crossbars. The female has the fins colored as in the male. Length $2\frac{1}{2}$ inches. Mexico and Guatemala. (Günther.) (Named for John M. Dow, its discoverer.)

*Pœcilia dovii*, GÜNTHER, Cat., VI, 344, 1866, Lake Nicaragua; Lake Amatitlan. (Coll. Dow.)
*Gambusia plumbea*,[*] TROSCHEL, in Müller's Reise in Mexico, III, 640, 1865, Mexico, no locality.

### 1030. PŒCILIA COUCHIANA (Girard).

Head 5 in total with caudal; eye 3 in head. D. 9; A. 6. Body short, back convex; head small; scales very large. Dorsal longer than high, inserted nearer base of caudal than tip of snout; anal opposite its hinder portion; pectorals not reaching ventrals. Brownish, each scale with a large brown spot; an obscure black lateral band; fins plain, except the dorsal, which has a few black spots. Known from females only. Rio San Juan, at Cadareita and Monterey, in Nuevo Leon. (Girard.) (Named for Lieut. D. N. Couch, of the Mexican Boundary Survey.)

*Limia couchiana*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 116, Rio San Juan. (Coll. Couch).
*Pœcilia couchii*, GÜNTHER, Cat., VI, 347, 1866.
*Pœcilia couchiana*, JORDAN & GILBERT, Synopsis, 348, 1883.

### 1031. PŒCILIA BOUCARDI,[†] Steindachner.

Head $3\frac{1}{2}$; depth 3. D. 9 or 10; A. 9; scales 27 or 28–9. Eye $3\frac{1}{5}$ in head, as long as snout; interorbital width $1\frac{4}{5}$ in head. Dorsal in females inserted an eye's diameter nearer base of caudal than opercle, farther back in male. Dorsal, caudal, and pectoral dark grayish, the dorsal punctate in both sexes, the spots arranged in several rows, sometimes gathered in blotches; caudal with cross rows of dots; anal dotted in old females only; sides of body with faint, dark-gray cross bands. Length 3 inches. Streams at Colon, on the Atlantic side of the Isthmus of Panama. (Steindachner.) (Named for Alphonse Boucard, the ornithologist, who collected in tropical America.)

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[*] *Gambusia plumbea*: D. 10; A. 9; P. 14. Length $2\frac{1}{2}$ inches. Greatest height more than length of head, $4\frac{1}{3}$ in total length. Insertion of dorsal nearer caudal than tip of snout, over tip of pectoral and end of anal, $\frac{2}{3}$ depth of body below it; anal in male $\frac{2}{3}$ height of body. Brownish plumbeous, yellowish below; dorsal and caudal with many dark points, those on caudal mostly near base.

[†] A species allied to *P. boucardi* is mentioned as follows by Müller & Troschel, Steindachner, Monatsber. Akad. Wiss. Berl., 1844, 36:
"*Molinesia fasciata*, MÜLLER & TROSCHEL: D. 8; A. 9; mit dunkeln Querbinden. Mexico." Fortunately the name *Pœcilia fasciata* is preoccupied.

*Pœcilia boucardi*, Steindachner, Ichth. Beitr., vi, 8, 1878, Colon; Aspinwall.

### 1032. PŒCILIA VANDEPOLLI, Van Lidth de Jeude.

Depth 3; D. 8; A. 9; scales 25 to 27–9. Eye 3 in head. Female with the anal a very little behind dorsal; male with the anal much advanced and the ventrals produced; outer teeth curved, all of them brown at tip. Yellowish brown, silvery below; a dark spot behind interorbital region, continued as a dark line along middle of back; dark edges of scales giving the body a reticulated appearance; sometimes faint cross-bands on tail, male sometimes with a black spot as large as eye above and behind root of pectoral. Length 1⅖ inches. Brooks on the island of Curaçao, one of the Leeward Islands in the Caribbean Sea. (Lidth de Jeude.) (Named for J. R. H. Neervoort van de Poll, its collector.)

*Pœcilia vandepolli*, Van Lidth de Jeude, Notes from Leyden Museum, ix, 438, 1887, Curaçao, one of the Leeward Islands. (Coll. Neervoort van de Poll).

Represented in the brooks of the neighboring island of Aruba by

### 1032a. PŒCILIA VANDEPOLLI ARUBENSIS, Van Lidth de Jeude.

Body deeper, the depth 3½ in length; anal more advanced in females, opposite dorsal fin. Dorsal and caudal with black lines and spots, the color otherwise as in *P. vandepolli*. Length 2⅓ inches. Streams of Aruba. (Van Lidth de Jeude.)

*Pœcilia vandepolli arubensis*, Van Lidth de Jeude, Notes from Leyden Museum, ix, 438, 1887, Aruba, one of the Leeward Islands. (Coll. Neervoort van de Poll).

### 1033. PŒCILIA DOMINICENSIS, Cuvier & Valenciennes.

Head 4; depth 3⅔. D. 8; A. 7 or 8; scales 28–8. Origin of dorsal a little nearer root of caudal than to occiput, nearly opposite that of anal; dorsal and anal fins small, rounded. Tail of moderate height, its least depth less than length of head without snout. A dark line along the middle of the back; sometimes irregular, indistinct blackish spots on the back; caudal with 2 light-brownish cross-bands. San Domingo and Barbadoes. Known from females only. (Günther.)

*Pœcilia dominicensis*, Cuvier & Valenciennes, Hist. Nat. Poiss., xviii, 131, pl. 525, 1846, San Domingo; Günther, Cat. vi, 346, 1866.

### 1034. PŒCILIA MELANOGASTER, Günther.

Head 3¾; depth 3⅓. D. 8; A. 8; scales 26–8. Eye of full-grown specimens somewhat more than length of snout, 3¼ in head, and more than half width of interorbital space. Origin of dorsal midway between root of caudal and occiput, over eleventh scale of the lateral series, scarcely in advance of that of anal; dorsal and anal fins small; base of the caudal scaly; tail of moderate length, its least depth scarcely equal to length of head, without snout; seven longitudinal series of scales on each side of the tail. Body light brownish, a silvery vertical streak on each scale. A small blackish spot in the middle of the root of the caudal; a blackish spot across the base of the three posterior dorsal rays; the prominent belly of females silvery in its anterior half, and deep black in its posterior, these colors being sharply separated from each other. Locality unknown, perhaps Jamaica. (Günther.) (*μέλας*, black; *γαστήρ*, belly.)

*Pœcilia melanogaster*, GÜNTHER, Cat., VI, 345, 1866, locality unknown.

### 1035. PŒCILIA SPILURUS, Günther.

Head 4; depth 3½; eye longer than snout, 3 in head, and ⅗ width of interorbital space. D. 7; A. 8; scales 26–9. Width of interorbital space a little less than distance between gill opening and center of eye; Origin of dorsal midway between root of caudal and upper end of gill opening, over thirteenth scale of the lateral series; origin of anal fin distinctly in advance of that of dorsal (in female); dorsal and anal fins small; base of the caudal fin covered with scales. Tail of moderate height, its least depth being equal to the length of the head (without snout). Brownish olive, each scale darker in the center; a black spot on each side of the back of the root of the tail; dorsal fin with a few black spots along the middle. Length 2½ inches. Central America. Known from one female. (Günther.) (*σπῖλος*, spot; *οὐρά*, tail.)

*Pœcilia spilurus*, GÜNTHER, Cat., VI, 345, 1866, Central America.

### 1036. PŒCILIA ELONGATA, Günther.

Head 4⅓; depth 4. D. 9; A. 8; scales 30 to 32–9. Caudal peduncle deep, its least depth 1⅔ in its own length, and a little less than length of head, without snout. Eye equal to length of snout, 3½ in head, and more than half width of interorbital space. Snout much depressed. Lower jaw with two series of very small teeth only; in the upper the posterior band of villiform teeth is very indistinct. Origin of dorsal fin nearer root of the caudal than occiput, a little behind root of anal, above fourteenth scale of lateral series; dorsal fin higher than long, its longest ray being as long as the head without snout; anal small. Eight longitudinal series of scales on each side of the tail. Caudal rounded, its base only covered with scales. Uniform olivaceous, sometimes with 10 or 12 faint cross shades; the membrane of the pouches of scales with a black margin; fins immaculate. A large and easily known species, abundant in mouths of streams about Panama; the only species thus far recorded in salt water. Length 4½ inches. (*elongatus*, lengthened.)

*Pœcilia elongata*, GÜNTHER, Cat., VI, 342, 1866, Panama; STEINDACHNER, Ichth. Beitr., V, 1876.

### 1037. PŒCILIA PRESIDIONIS, Jordan & Culver.

Head 4⅕; depth 3½ to 4⅕; eye as long as snout, 3½ in head; interorbital space 2 in head. D. 7 or 8; A. 7; scales 28–9. Body rather elongate, shaped as in *Fundulus*, the profile scarcely rising to front of dorsal. Teeth small, in two well-separated series, those of the inner row small, close-set, not trifid. Fins all low and short; pectoral 1⅓ in head; longest dorsal ray 1⅓; caudal truncate, 1⅕; dorsal in female inserted over middle of anal, behind anal in male. Males scarce, apparently smaller than females. Female greenish above; sides with violet sheen; 3 or 4 black crossbars, usually very distinct, sometimes obsolete in large examples; one or two oblong spots before these in the place of other bars; last ray of dorsal with a trace of a dark ocellus; fins otherwise plain; a dark streak along lower edge of caudal peduncle, and another like a pencil mark along middle of sides under the scales. Males without crossbars and with the lower fins reddish. Length 2 inches; very abundant in the clear waters of Rio Presidio, a mountain stream of Sinaloa, 20 miles south of Mazatlan. Many specimens obtained.

*Pœcilia presidionis*, JORDAN & CULVER, MS., Fishes of Sinaloa, 1895, Rio Presidio, Sinaloa. (Type, No. 2687. Stanford Univ. Mus. Coll. Hopkins Expedition.)

## 319. MOLLIENISIA, Le Sueur.

*Mollienisia*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., II, 1821, 3, plate III, (*latipinna*).

Body rather stout. Mouth small; mandible very short, its bones not united, the dentary being movable; both jaws with a narrow band of small teeth, besides an outer series of long, slender, movable teeth, which are curved and slightly compressed, placed on the outer edge of the jaw. Branchiostegals 5. Scales large. Anal fin behind the dorsal, the anal of the male being modified into an intromittent organ; caudal fin alike in the two sexes, or the lower angle very slightly produced in the male, suggesting *Xiphophorus*; dorsal fin highly elevated in the male, its base elongate, of 12 or more rays. Intestines elongate, with numerous convolutions. Vertebræ 17 + 13 = 30. Small mud-eating fishes, of variegated colors, found from Carolina to Mexico, in the coastwise swamps. The genus is scarcely distinct from *Pœcilia*, differing only in the larger dorsal and the gayer coloration of the male. The species are closely related, and are perhaps all forms of the widely distributed and variable *Mollienisia latipinna*. (Named for Mollien, French minister of finance, a patron of Péron, the friend and scientific associate of Le Sueur.)

*a*. Dorsal rays 12 or 13.
  *b*. Insertion of anal behind front of dorsal; a round black spot on upper half of base of caudal; each scale edged with dark; dorsal with 2 or 3 series of black spots. JONESI, 1038.
  *bb*. Insertion of anal under front of dorsal; each scale of back with a brown spot; dorsal spotted. FORMOSA, 1039.
*aa*. Dorsal rays 13 to 15; dorsal fin in male much elevated and with series of spots; dorsal beginning in advance of anal; scales with dark spots.
  *c*. Scales 26 to 28–10; dark spots on scales forming lengthwise stripes along back and side; caudal rounded. LATIPINNA, 1040.
  *cc*. Scales 30–10; dark spots chiefly on posterior part of body; lower angle of caudal produced in adult male. PETENENSIS, 1041.

### 1038. MOLLIENISIA JONESI, Günther.

Head 4; depth 3½ to 4. D. 12; A. 10; scales 29–9. Eye shorter than snout, 4 in head, 2 in interorbital width; length of dorsal fin ¼ distance from eye to base of caudal. Dorsal (in female) much longer than high; anal small, opposite middle of dorsal. Brownish; each scale with a black posterior margin; a black band between eye and scapula; a round black spot on upper half of root of caudal; dorsal with 2 or 3 series of black spots; anal with a black line behind and along each ray; other fins plain. Length 3¼ inches. Lake Alcohuaca, a volcanic lake, Huamantla, Mexico, 8,000 feet above sea. Known from females only. (Günther.) (Named for T. M. Rymer Jones, its discoverer.)

*Mollienesia jonesi*, GÜNTHER, Ann. Mag. Nat. Hist., XIV, 1874, 370, Lake Alcohuaca, Huamantla, Mexico; JORDAN & GILBERT, Synopsis, 347, 1883.

### 1039. MOLLIENISIA FORMOSA (Girard).

Head 3¼; depth 3¼; eye 3 in head. D. 12 or 13; A. 10. Body rather stout. Snout short; dorsal in male longer than high, its first ray about opposite front of anal; female with the dorsal nearly as high as long, the anal opposite its front. Olivaceous; scales with brown spots; dorsal fin with transverse series of blackish spots; other fins immaculate. Palo Alto, Mexico. (Girard.) (*formosus*, comely.)

*Limia formosa*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 115, Palo Alto, Mexico. (Coll. Clark.)
*Mollienesia formosa*, GÜNTHER, Cat., VI, 349, 1866; JORDAN & GILBERT, Synopsis, 347, 1883.

### 1040. MOLLIENISIA LATIPINNA, Le Sueur.

Male: Head 4; depth 2¾ to 3. Female: Head 3½ to 3¾; depth 2½ to 2⅗. D. 15 or 16 (13 or 14 in var. *lineolata**); A. 8; scales 26–9 or 10. Body oblong, much compressed in males, of nearly equal height from dorsal backward, the greatest height of body but ⅓ greater than that of caudal peduncle; females with gibbous belly and narrower caudal peduncle; head very small, depressed, not narrowed forward; mouth very small, vertical, and without lateral cleft; length of mandible about ⅔ diameter of orbit; teeth all very small, movable, in a rather narrow band; the outer series much larger than the others, but still very small, composed of slender pointed teeth, strongly curved inward; eye moderate, 1½ to 1⅔ in interorbital width, equal to or slightly greater than snout, and 3⅓ to 3½ in head. Dorsal very long, in adult males enormously elevated, exceeding height of body; the fin is almost square, the base slightly longer than the height, the upper margin nearly straight; longest ray 2½ in length of body, the last ray reaching beyond base of caudal; base of fin 2¼ in body; origin of dorsal distant from base of caudal 2⅕ times its distance from the tip of snout. In females dorsal low, the longest ray equaling ⅔ length of head, the last ray reaching but halfway to base of caudal; the base of the fin 3⅖ times in length of body, its origin distant from base of caudal 1¼ times the distance from tip of snout. Anal very small; in the male modified into an intromittent organ and inserted in advance of middle of dorsal, its origin about halfway between snout and base of caudal, the fourth ray longest and thickest, 1¼ in head; in females the origin is under twelfth ray of dorsal, and about midway between tip of caudal and tip of snout. Caudal rounded, about equaling length of head in females, ¼ greater than head in males. Ventrals inserted behind vertical from origin of dorsal, reaching beyond vent in females; in males the first and second rays are thickened, the second filamentous, 1½ in head. Pectoral long, longer in males, where it reaches beyond middle of ventrals, and is very slightly less than length of head. Scales in very regular rows, 26 in a longitudinal series, 9 or 10 in an oblique series forward from vent to middle of back; humeral scale not enlarged. Intestinal canal about 2½ times total length of fish (with caudal). Color, male light olive green, marbled with darker and spotted with pale green; each scale on back and sides with an oblong, blackish spot, these forming continuous lengthwise stripes; head dusky above; opercle and cheek minutely speckled; an orange stripe above opercle; lower parts of head mostly orange; some orange tinge on breast. Dorsal translucent, its basal half with about 5 series of linear, blackish, horizontal spots, forming interrupted lines; above middle of fin, on membrane between each pair of rays, is a large, roundish dark spot; between these spots and above them are many small, round bronze spots; membrane between second and third rays red at base; all of these markings irregular on first and last rays; caudal narrowly margined all around with black, its base lavender, its lower parts mostly whitish, the middle orange, the upper parts pale, with round orange spots; other fins pale orange. Females have dorsal and caudal olivaceous, with indistinct, narrow cross bands, formed by series of small dark spots on the rays. Length 2½ to 3 inches. South Carolina to northern Mexico, in lowland swamps and streams; very abundant. The male a fish of remarkable beauty. It often enters the sea, the gorgeous dorsal fin of the male being conspicuous in the shallow water about the wharves at Pensacola. (*latus*, broad; *pinna*, fin.)

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* Var. *lineolata*, GIRARD: Four female specimens and one male, from Galvestou, Texas, (the largest 2 inches long), and two females from Lake Pontchartrain, were formerly referred by us to a variety *lineolata* (=*pœcilioides*). Later investigations have not confirmed the validity of this form. They show the following apparent differences from *M. latipinna*:

Eye small, the iris jet black; diameter of orbit 3⅓ to 3½ in head and 1¾ to 2 times in interorbital width, (the eye 2⅞ in head and 1⅗ in interorbital width, in *latipinna* of the same size); dorsal fin smaller, its base 3⅞ in body in females, 3 in males, the rays constantly 13 or 14 in number (usually 13); origin of dorsal equidistant from tip of snout and base of caudal in female. Color as in *latipinna*, with traces of dark bars.

*Mollienesia latipinna*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., II, 1821, 3, New Orleans; male; GÜNTHER, Cat., 348, 1866; JORDAN & GILBERT, Synopsis, 347, 1883.

*Pœcilia multilineata*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., II, 1821, 4, New Orleans; female.

*Pœcilia lineolata*, GIRARD, U. S. Mex. Bound. Surv., Ichth., 70, pl. 35, figs. 9 to 11, 1859, Rio Grande, near Brownsville, Texas. (Coll. Van Vliet and Clark.)

*Limia pœciloides*, GIRARD, U. S. Mex. Bound. Surv., Ichth., 70, pl. 38, figs. 8 to 14, 1859, Indianola, Texas. (Coll. Clark.)

*Limia matamorensis*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 116, Matamoras.

*Mollienesia latipinna*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 258; JORDAN & GILBERT, Synopsis, 347, 1883.

*Mollienesia lineolata*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 258.

### 1041. MOLLIENISIA PETENENSIS, Günther.

Head 4 to 4½; depth 3; eye 3½ in head. D. 15; A. 8 or 9; B. 6; scales 30–10; vertebræ 17 + 13. Eye equal to length of snout, rather less than half of width of interorbital space. Length of dorsal fin of male half distance between eye and root of caudal, in the female ⅖; caudal rounded, with scales at base only. Free portion of the tail as high as long, and covered by 9 longitudinal series of scales on each side. Brownish green, silvery below; a dark spot to each scale of the upper and middle caudal series and the lower part of the trunk; dorsal fin of the adult male with small, irregular brown lines or spots, and with a row of large rounded spots along the middle of its height; interradial membrane of the caudal with numerous black dots; the lower part of the hind margin black. Females and immature males have the dorsal fin simply ornamented with small irregularly curved brown spots. Length 5 inches. Lake Peten. (Günther.) Extremely close to *M. latipinna*, but reaching a larger size, its angulated caudal suggesting *Xiphophorus.*

*Mollienesia petenensis*, GÜNTHER, Cat., VI, 348, 1866, Lake Peten, in Guatemala. (Coll. Salvin.)

## 320. XIPHOPHORUS, Heckel.

*Xiphophorus*, HECKEL, Sitzgsber. Akad. Wiss. Wien, 1848, I, pt. 3, 163, (*helleri*).

This genus differs from *Mollienisia* only in the structure of its caudal fin, the lower rays of which in the males are prolonged into a long sword-shaped appendage, which in the adult is sometimes as long as the rest of the fish. Anal of the male modified into an intromittent organ, 1 or 2 of the enlarged rays being provided with hook-like processes. Branchiostegals 5. Vertebræ 16 + 14 = 30. (ξίφος, sword; φορέω, to bear.)

*a.* Sides in both sexes with dark lines of spots along the rows of scales; a darker stripe on side running along upper edge of caudal projection. HELLERI, 1042.

*aa.* Sides in both sexes covered with irregular black blotches and spots, not following the rows of scales; no lateral stripe. GUNTHERI, 1043.

### 1042. XIPHOPHORUS HELLERI, Heckel.

Head 4⅓; depth 3½ to 3⅘. D. 13; A. 9; V. 6; scales 29–8. Eye as long as snout, 3½ in head. Dorsal nearly equal in males and females, its base 3½ in distance from head to caudal; caudal sword in adult male nearly as long as the fish, yellow, with black edges; ventrals below front of dorsal in both sexes. Body in female with regular series of dark spots forming lines along the rows of scales as in *Mollienisia*; dorsal plain in the female, spotted in the male, the spots in horizontal rows. Rivers of southern Mexico and Central America. Günther describes three varieties in the coloration of males; variations possibly representing distinct species:

*a.* Two yellowish-green bands along side, separated and bordered above and below by a blue band. Rio Chisoy.

*b.* Middle blue band darkest, black, running from eye to and along upper border of caudal appendage, which is very short. Cordova.

*c.* Body without bands, covered all over with irregular black spots in both sexes. Rio Chisoy. This form (figured by Günther, Fish. Centr. Amer., 1869, pl. 87) we have here regarded as a distinct species, *Xiphophorus guntheri.*

(Named for Prof. Karl Heller.)

*Xiphophorus helleri*, HECKEL, Sitzgber. Akad. Wiss. Wien, 1848, I, 163; GÜNTHER, Cat., VI, 349, 1866; GÜNTHER, Fishes Centr. Amer., 485, 1869.

### 1043. XIPHOPHORUS GUNTHERI, Jordan & Evermann, new species.

We regard Günther's "var. $\gamma$" (*gamma*) from Rio Chisoy, "Body without bands, covered all over with irregular spots" as probably a species distinct from *X. helleri*. Günther's figure shows the form, proportions, and fin rays of the latter, the dorsal in the female lower and more spotted, and both sexes covered with dark blotches of various sizes, irregular in form and distribution, more of them vertical than horizontal, and covering head, back, and sides; caudal unspotted, its appendage white, edged with black above and below. Rio Chisoy, basin of Rio Usumacinta, Guatemala. (Named for Dr. Albert Günther.)

*Xiphophorus helleri*, var. $\gamma$, GÜNTHER, Cat., VI, 350, 1866, Rio Chisoy, Guatemala. (Coll. Godman & Salvin); and GÜNTHER, Fishes Centr. Amer., pl. 87, figs. 3 and 4, 1869.

## Family XCIII. AMBLYOPSIDÆ.

### (THE BLIND FISHES.)

Body moderately elongate, compressed behind. Head long, depressed. Mouth rather large, the lower jaw projecting; premaxillaries long, scarcely protractile, forming entire margin of upper jaw. Jaws and palatines with bands of slender villiform teeth. Branchiostegals about 6. Gill rakers very short. Pseudobranchiæ concealed. Gill membranes more or less completely joined to the isthmus. Head naked, the surface sometimes crossed by papillary ridges. Body with small cycloid scales, irregularly placed; no lateral line. Vent jugular, close behind the gill openings. Ventral fins small or wanting; pectorals moderate, inserted higher than in most soft-rayed fishes; dorsal without spine, nearly opposite the anal; caudal truncate or rounded. Cranium without median crest. Stomach cœcal, with 1 or 2 pyloric appendages. Air bladder present. Ovary single. Some (and probably all) of the species ovoviviparous. In two of the genera the eyes are very rudimentary and hidden under the skin, and the body is translucent and colorless. Fishes of small size, living in subterranean streams and swamps of the southern United States. Three genera and five species are "all of the family yet known, but that others will be discovered, and the range of the present known species extended, is very probable. The ditches and small streams of the lowlands of our southern coast will undoubtedly be found to be the home of numerous individuals, and perhaps of new species and genera, while the subterranean streams of the central portion of our country most likely contain other species." (Putnam.) This group is doubtless a very ancient one and the blind forms are without doubt descendants of the eyed genus *Chologaster*, or at least of forms closely allied to it. The singular position of the vent is repeated in the peculiar family, *Aphredoderidæ*, likewise a relic of a lost fauna. (*Heteropygii*, Günther, Cat., VII, 1, 2, 1868.)

- *a.* Eyes developed; body colored; ventrals obsolete; pyloric cœca 2. CHOLOGASTER, 321.
- *aa.* Eyes rudimentary, concealed; body colorless; pyloric cœcum single.
  - *b.* Ventral fins present. AMBLYOPSIS, 322.
  - *bb.* Ventral fins obsolete. TYPHLICHTHYS, 323.

## 321. CHOLOGASTER, Agassiz.

*Chologaster*, AGASSIZ, Amer. Journ. Sci. Arts, XVI, 1853, 135, (*cornutus*).

This genus includes those *Amblyopsidæ* which retain the eyes in their primitive condition of development, and which retain the structure and color of ordinary fishes. Pyloric cœca 2. Swamps of the Southern States, entering caves. From allies of *Chologaster cornutus* all the other forms have probably descended, though the possession of ventrals in *Amblyopsis* indicates their existence in the primitive type. (χωλός, maimed; γαστήρ, belly; in allusion to the abortive ventrals.)

- *a.* Papillary ridges wanting.
  - *b.* Sides with 3 narrow, sharply defined, lengthwise black stripes, the middle one broadest; a black blotch at base of caudal, with a white blotch behind it, the fin otherwise black. CORNUTUS, 1044.
  - *bb.* Sides plain light brown, unstriped. AGASSIZII, 1045.
- *aa.* Papillary ridges present, as in the Blindfishes; sides with 3 black lengthwise stripes. PAPILLIFERUS, 1046.

### 1044. CHOLOGASTER CORNUTUS, Agassiz.

(FISH OF THE DISMAL SWAMP.)

Head 3⅖; depth 5½ to 6½. D. 8 or 9; A. 8 or 9; scales 68. Form of *Amblyopsis*, but more slender, the head narrower, sharper, and less depressed; mouth oblique, terminal, the lower jaw projecting; maxillary extending nearly to front of eye; eye small, but evident, about half length of snout. Gill membranes separate, nearly free from the isthmus, covering the vent. Pectoral fin 1½ in head, 1⅖ in distance to front of dorsal; caudal pointed, about as long as head. Color very dark brown above, the lower half of body abruptly white, all parts, black or white, sprinkled over with black points; side with 3 narrow, sharply defined, black, lengthwise stripes, the lower sometimes breaking up into dots behind, the middle stripe broadest, forming the lower margin of the dark color of back, this stripe extending on side of head across eye and snout; upper band a little nearer to line of back than to middle band; a large, irregular black blotch at base of caudal; behind this a white blotch of varying size, sometimes reduced to 2 small spots, sometimes forming a broad white bar, covering nearly half the fin; behind this blotch the caudal fin is jet black; dorsal white, more or less spotted or edged with black. Length 1⅘ inches. Lowland swamps of the Southern States, from the Dismal Swamp to the Okefinokee Swamp; locally very abundant. The above description is taken from the types of *Chologaster avitus*. The study of specimens from Georgia leads to the conclusion that the nominal species *avitus* is based on a slight variation of *cornutus*; the body slenderer. the color a little different. (*cornutus*, horned; the inconspicuous "horns" are the flaps of the nostrils.)

*Chologaster cornutus*, AGASSIZ, Amer. Journ. Sci. Arts, 1853, 135, ditch in a rice field at Waccamaw, South Carolina; GÜNTHER, Cat., VII, 2, 1868; PUTNAM,* Amer. Nat., 1872, 30; JORDAN & GILBERT, Synopsis, 325, 1883.

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*The following is the substance of Professor Putnam's description of Agassiz's type: Head 3⅛; depth 4½. D. 8 or 9; A. 8 or 9. Yellowish brown, dark above; sides with 3 dark longitudinal stripes, becoming dots on the tail; middle rays of caudal fin dark; fins otherwise uncolored. Mouth moderate, oblique, the maxillary not extending to the eye. Pectorals reaching nearly to front of dorsal, perfect, small. Snout with 2 horn-like projections (nasal flaps). Length 2½ inches.

*Chologaster avitus*, Jordan & Jenkins, Proc. U. S. Nat. Mus., 1888, 356, pl. 44, fig. 8, outlet of Lake Drummond, Dismal Swamp, near Suffolk, Virginia. (Type, No. 39864. Coll. Jenkins & Meek.)

*Chologaster cornutus*, Gilbert, Bull. U. S. Fish Comm., VIII, 1888, 227, specimens from Okefinokee Swamp, Millen, Georgia; caudal fin more dusky, with little white at base.

### 1045. CHOLOGASTER AGASSIZII, Putnam.

Head 4 in body, its length scarcely greater than the greatest depth. D. 9; A. 9. Pectorals reaching little more than halfway to front of dorsal. Uniform light brown; fins somewhat speckled. Length 1¼ inches. (Putnam.) Subterranean streams in Tennessee and Kentucky; not seen by us. (Named for Louis Agassiz.)

*Chologaster agassizii*, Putnam, Amer. Nat., 1872, 30, fig., from a well at Lebanon, Tennessee.

### 1046. CHOLOGASTER PAPILLIFERUS, Forbes.

Head 3½ in length. Body with ridges of tactile papillæ, as in *Amblyopsis*. Eye above and well behind maxillary, about 6 in head; pectoral reaching halfway to the dorsal. Color precisely as in *Chologaster cornutus*, except that the middle stripe is decidedly paler than the ground color of the body, but darker on the head, the change being abrupt at the opercular margin; caudal fin dark brown, with several vertical rows of white specks or blotches running across the rays; anterior part of dorsal similar in color, but paler. Length a trifle over an inch. The species, agreeing with *cornutus* in position of eye and plan of markings, with *agassizii* in length of pectorals and structure of scales, is intermediate in length of head, and agrees with neither in color of caudal and dorsal and tint of middle band. (Forbes.) Cave Spring, Union County, Illinois. (*papilla*, papilla; *fero*, I bear.)

*Chologaster papilliferus*, Forbes, Amer. Naturalist, Jan., 1882, 1, cave spring in Southern Illinois. (Coll. F. S. Earle.)

*Chologaster papillifer*, Jordan & Gilbert, Synopsis, 325, 890, 1883.

## 322. TYPHLICHTHYS, Girard.

*Typhlichthys*, Girard, Proc. Ac. Nat. Sci. Phila., 1859, 62, (*subterraneus*).

This genus differs from *Amblyopsis* only in the absence of the ventral fins. The body is similarly translucent, covered with papillary ridges and the eyes are obsolete. The single species is of smaller size, and found in the same waters. (*τυφλός*, blind; *ἰχθύς*, fish.)

### 1047. TYPHLICHTHYS SUBTERRANEUS, Girard.

(Small Blindfish.)

D. 7 or 8; A. 7 or 8. Head rather blunter and broader forward than in *A. spelæus*. Mouth smaller, its cleft shorter than base of dorsal. Pectorals scarcely reaching dorsal. One pyloric cœcum. Colorless. Length 2 inches. Subterranean streams of limestone regions in Indiana, Kentucky, Tennessee, Missouri, and Alabama; locally abundant, with *Amblyopsis spelæus*, but more widely diffused than the latter. (*subterraneus*, under the earth.)

*Typhlichthys subterraneus*, Girard, Proc. Ac. Nat. Sci. Phila., 1859, 62, well at Bowling Green, Kentucky; (Coll. J. E. Younglove); Putnam, Amer. Nat., 1872, 30, fig.; Jordan & Gilbert, Synopsis, 325, 1883; Garman, Bull. Mus. Comp. Zoöl., XVII, No. 6, 232, 1889.

Concerning the distribution and habits of this fish, Mr. Garman gives the following pertinent remarks:

"*Typhlichthys subterraneus*, Girard, the only blindfish in the collection (of Miss Ruth Hoppin, from caves in Jasper County, in southern Missouri) is represented by a large number of examples, the majority of them taken from the wells, the balance from the caves, with the exception of a single one from the creek outside. Compared with specimens from Kentucky and Tennessee, they agree so exactly as to raise the question whether the species was not originated in one of the localities and thence distributed to the others. The opinion generally held is that the cave species of Indiana, Kentucky, and Tennessee originated in their respective localities. It is no doubt true for some of them. The idea is well supported by the insects and crustacea, the species in one section being unlike those of the others. It may be urged that the respect in which the fishes differ from them is more apparent than real, since these crustacea and insects were derived from a number of distinct species, while in all probability the same species of fish entered the caves in each district, and, being under the same influences in each, suffered the same modification in each. Reduced to its lowest terms the question, so far as the fishes are concerned, is this: Were the blindfishes distributed to the scattered localities where now found before or after they became blind? In favor of independent origins at distant points, it can be said that a species, distributed over the valley, possessed of habits such as would lead it to place itself under the modifying conditions of the cave in one place, would be most likely led to do so in the others. On the other hand, we have the more hesitation in accepting the conclusion that one and the same species originated independently in two or more different localities, from knowing that exact parallels in the development of animals in nature, if they exist, are excessively rare. If our caution prevents ready acceptance of two apparently exact evolutionary parallels as really coincident, we become more skeptical when the number of parallels or coinciding lines is increased. There is no doubt that the representatives of *Typhlichthys subterraneus* in the various caves were derived from a single common ancestral species. The doubts concern only the probability of the existence of three or more lines of development, in as many different locations, starting from the same species and leading to such practical identity of result. Such identical results would demand substantially similar modifying elements—darkness, temperature, food, enemies, etc.—and the same length of time subjected to their influence. The likelihood of the existence of so many like elements in distant regions is inversely to the number demanded, though one can not say it is impossible. To accept the conclusion favoring independent developments of the same species would involve acceptance of the idea that the caves in each of the districts had been occupied for about the same period of time. This, of course, would not furnish us with any clue to the time of formation of the caves. As an alternative, the opinion is here advanced that these blindfishes originated in a particular locality, and have been, and are being, distributed among the caves throughout the valley.

"We are in the habit of looking upon great rivers like the Ohio or Mississippi as impassable obstacles to passage from cave to cave, rather than as thoroughfares. In this we have certainly assumed too much. Various instances are on record of the discovery of blindfishes that have strayed into the open streams from their caverns. If there were means of determining the frequency of the occurrence of such instances, it would undoubtedly much exceed what we are now inclined to credit. Persons acquainted with the streams of the Mississippi basin will agree that their undermined banks provide series of recesses or caverns, extending from the rills at the sources to the tributaries and to the Gulf. The currents do not prove insurmountable to multitudes of fishes, no better provided with locomotive organs than the blindfishes, passing up the streams every season. Swept from the caves by the torrents in the flooded mouths, the blind species would find itself protected at once from light or enemies by the turbid waters. The temperature of the water at such times is low, and, should the light penetrate so as to prove detrimental, retreats exist on every hand in the excavations of the banks or the mud of the bottom. What migrations these fishes may make in winter we can only imagine. Hiding places are so numerous and extensive as to suggest the possibility of the evolution of blind forms without the caves. The great essential would be the disposition to avoid the light, opportunities existing everywhere; the surroundings then would bring the organization into harmony with their demands, sooner or later, as the creature was more or less plastic and yielding; disuse of the sense of sight being followed by its loss and atrophy of its special organ. Development of sightless forms in the holes and burrows of the banks, or in the mud of the bottom of the river, would here follow a similar course to that gone through at great depths in lake or ocean.

"Crooked streams are not so impassable as one might suppose, even to floating objects, insects, mollusks, etc. A twig or leaf dropped into the current on the inside of the upper arm of a horseshoe curve in a stream is carried near to the opposite shore before it leaves the bend, and, especially if favored by the wind, is often carried completely across. The passage is much easier to animals that swim, however feebly. Taking everything into the account, it does not appear to be at all necessary to credit *Typhlichthys subterraneus* from Kentucky, Tennessee, and Missouri with more than a single point of origin. The same may be said of *Amblyopsis spelæus* of Kentucky and Indiana, and of the blind crayfish of the same States.

"In an article entitled 'Life in the Wyandot Cave,' Ann. Mag. Nat. Hist., Ser. 4, VIII, 1871, p. 368, Professor Cope makes this statement concerning *Amblyopsis:* 'If these *Amblyopses* be not alarmed, they come to the surface to feed, and swim in full sight, like white aquatic ghosts. They are then easily taken by the hand or net, if perfect silence is preserved; for they are unconscious of the presence of an enemy, except through the medium of hearing. This sense, however, is evidently very acute, for at any noise they turn suddenly downward and hide beneath stones, etc., on the bottom.' The statement is repeated in Amer. Nat., 1872, p. 409. Such a development of this sense, in recesses where we are accustomed to think any sounds other than those made by the rippling or dripping water are almost unknown, is not what one would have expected. Having this in mind, I wrote to Miss Hoppin, asking her to make experiments on *Typhlichthys*, and to determine what she could in regard to hearing, feeding habits, etc. The quotations here given are from her replies:

"'For about two weeks I have been watching a fish taken from a well. I gave him considerable water, changed once a day, and kept him in an uninhabited place subject to as few changes of temperature as possible. He seems perfectly healthy, and as lively as when first taken from the well. If not capable of long fasts, he must live on small organisms my eye can not discern. He is hardly ever still, but moves around the sides of the vessel constantly, down and up, as if needing the air. He never swims through the body of the water away from the sides, unless disturbed. Passing the finger over the sides of the vessel under water, I find it slippery. I am careful not to disturb this slimy coating when the water is changed. * * * Numerous tests convince me that it is through the sense of touch, and not through hearing, that the fish is disturbed: I may scream, or strike metal bodies together over him as near as possible, yet he seems to take no notice whatever. If I strike the vessel so that the water is set in motion, he darts away from that side through the mass of the water, instead of around, in his usual way. If I stir the water, or touch the fish, no matter how lightly, his actions are the same.'" [Garman, Bull. Mus. Comp. Zoöl., XVII, No. 6, 1889, 232.]

## 323. AMBLYOPSIS, De Kay.

*Amblyopsis*, DE KAY, New York Fauna: Fishes, 187, 1842, (*spelæus*).

Eyes rudimentary, concealed under the skin and not functional. Surface of head and body crossed by vertical tactile ridges. Gill membranes fully joined to isthmus. Ventral fins present, quite small, close to anal. One pyloric cœcum. Colorless fishes of small size, inhabiting the cave streams in the limestone regions of the Ohio Valley. (*ἀμβλύς*, obtuse; *ὄψις*, vision.)

### 1048. AMBLYOPSIS SPELÆUS, De Kay.

(BLINDFISH OF THE MAMMOTH CAVE.)

Head 3 in length; depth 4½. D. 9; A. 8; V. 4; P. 11. Body and head covered by fine ridges of tactile papillæ. Colorless. Mouth comparatively large, the length of its cleft about equal to base of dorsal. Pectorals reaching front of dorsal; caudal long, rather pointed. Length 5 inches. Subterranean streams of the limestone region of Kentucky and southern Indiana; not rare; most common in the River Styx of the Mammoth Cave. Very tenacious of life and readily kept in aquaria. (*spelæus*, pertaining to caves.)

*Amblyopsis spelæus*, DE KAY, N. Y. Fauna: Fishes, 187, 1842, Mammoth Cave, Kentucky; GÜNTHER, Cat., VII, 2, 1868; PUTNAM, Amer. Nat., 1872, 30, fig.; JORDAN & GILBERT, Synopsis, 324, 1883.

## Order Y. SYNENTOGNATHI.

### (The Synentognathous Fishes.)

Lower pharyngeal bones fully united; second and third superior pharyngeals variously enlarged, not articulated to the cranium, sending processes forward; the fourth small or fused with the third. Vertebræ numerous (45 to 70), the abdominal ones much more numerous than the caudal. Ventral fins abdominal, without spine, the rays more than 5. Scapula suspended to the cranium by a post-temporal bone, which is slender and furcate. Articular bone of lower jaw with a small supplemental bone perhaps corresponding to the coronoid bone. Parietal bones much reduced, well separated by the supraoccipital. Supraclavicle not distinct; no interclavicles. No mesocoracoid. Maxillary very close to premaxillary and sometimes firmly joined to it, the suture always distinct. Basis of cranium double in front, but without muscular tube. No adipose fin. Fins without spines. Lateral line concurrent with the belly, peculiar in structure. Air bladder usually large, without pneumatic duct. Intestinal tract simple, without pyloric cœca. This order* is allied to the *Haplomi* on the one hand and to the *Percesoces* on the other, and like these groups, it marks the transition from the soft-rayed to the spiny-rayed fishes. In their anatomical characters the *Synentognathi* most resemble the latter, but there are never spines in the fins, and the lower pharyngeals are united. The group is divisible into four closely related families, which have usually been regarded as subfamilies of one family, *Exocœtidæ* or *Scomberesocidæ*. The remarkable differences in the pharyngeals seem to us to require the division of the group into four families, the differential characters having been first pointed out by Mr. Edwin C. Starks, a student in Stanford University. (*σύν*, together; *ἐντός*, within; *γνάθος*, jaw.) (*Physostomi*, part; family *Scomberesocidæ*, Günther, Cat., VI, 233–298, 1866.)

*a.* Third superior pharyngeal on each side scarcely enlarged, not longer than its anterior process, and armed with comparatively few (about 15) pointed teeth; fourth superior pharyngeal distinct on each side; lower pharyngeals united into a small linear plate, armed with small teeth; vertebræ with zygapophyses; both jaws produced in a long beak in the adult (the upper short in the young); teeth in jaws strong, unequal; maxillaries firmly appressed to the premaxillaries; a distinct suture along the boundary; coronoid bone (attached to the articular) evident. Species carnivorous. ESOCIDÆ, XCIV.

*aa.* Third superior pharyngeal greatly enlarged, covered with bluntish, tricuspid teeth; fourth superior pharyngeal wanting or fused with the third; lower pharyngeals large, fused into a thick triangular bone with transversely concave surface, covered with blunt, tricuspid teeth; teeth in jaws always small, conic, or tricuspid; maxillary close to premaxillary, but not suturally joined to it, there being some open space between; coronoid bone small, but present; no canine teeth; no zygapophyses to the vertebræ.

  *b.* Third superior pharyngeal solidly joined with its fellow to form an ovoid plate, which sends two processes forward; cleft of mouth narrow; the lower jaw usually produced; teeth of jaws tricuspid; herbivorous species. HEMIRAMPHIDÆ, XCV.

  *bb.* Third superior pharyngeals more or less closely appressed, but not united; species at least partly carnivorous.

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* With this order begins the series of families in which the air duct of the air bladder disappears in the adult condition. These form the group or series known as *Physoclysti*, in contradistinction to the *Physostomi*, in which the air duct is persistent. To the *Physostomi* belong the *Ostariophysi*, *Apodes*, *Isospondyli*, *Haplomi*, etc.

*c.* Dorsal and anal fins each with several detached finlets; cleft of mouth long, both jaws being more or less produced in a pointed beak; paired fins small.
SCOMBRESOCIDÆ, XCVI.

*cc.* Dorsal and anal without finlets; cleft of mouth short, the jaws not produced in a beak; pectoral fins more or less produced, forming an organ of flight.
EXOCŒTIDÆ, XCVII.

## Family XCIV. ESOCIDÆ.

### (THE NEEDLEFISHES.)

Body elongate, very slender, compressed or not, covered with small, thin scales. Lateral line very low, running as a fold along side of belly. Both jaws produced in a beak, the lower jaw the longer, very much the longer in the young, which resemble *Hemiramphus*; maxillaries grown fast to premaxillaries; each jaw with a band of small, sharp teeth, besides a series of longer, wide-set, sharp, conical teeth. No finlets. Dorsal fin opposite anal, both fins rather long. Air bladder present. Lower pharyngeals united to form a long, slender, narrow plate, with flat surface, covered with small, pointed teeth; upper pharyngeals distinct, the third pair little enlarged, each with some 15 moderate, unequal, pointed teeth (*Tylosurus marinus*); fourth pair well developed, with similar teeth, but without anterior processes. Vertebræ numerous, with zygopophyses. Ovary single. Voracious, carnivorous fishes, bearing a superficial resemblance to the Gar Pikes; found in all warm seas, sometimes entering rivers. Genera 4, only 2 of which (*Tylosurus* and *Athlennes*) are found in our waters;* species about 50, the majority of them American. Their habits are ordinarily much like those of the pike, but when startled they swim along the surface with extraordinary rapidity, often leaping above the water for short distances. When thus leaping the large species of the tropics are sources of danger to incautious fishermen, sometimes piercing the naked abdomens of the savages. Most of them are good food-fishes, but the green color of the bones of the larger species often causes them to be avoided, for no good reason. (*Scomberesocidæ*, part, Günther, Cat., VI, 233–256, 1866.)

*a.* Gill rakers none; no teeth on vomer; dorsal and anal elevated in front; caudal fin lunate.
*b.* Body subterete or slightly compressed, its breadth more than $\frac{2}{3}$ its greatest depth.
TYLOSURUS, 324.
*bb.* Body much compressed, its breadth not half its greatest depth. ATHLENNES, 325.

## 324. TYLOSURUS,† Cocco.

*Tylosurus*, Cocco, "Lettere in Giornale Sci. Sicilia, XVII," 18, 1829, (*cantraini* = *imperialis* = *acus*).

Body elongate, very slender, not much compressed. Both jaws prolonged into a beak, the lower jaw somewhat the longer, much the longer in young fishes, the very young resembling *Hemiramphus*. Each jaw armed with a band of small, sharp teeth, beside which is a series of

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*The remaining genera are *Esox*, (*Belone*), and *Potamorrhaphis*. *Esox* is characterized by the presence of fin rakers and is confined to the Old World and the islands of the Pacific. *Potamorraphis* is similar to *Tylosurus*, but with the dorsal and anal not falcate. Its species inhabit the rivers of South America.

† For a full account of the American species of this genus see Jordan & Fordice, Proc. U. S. Nat. Mus., 1886, 339–361.

longer, wide-set, sharp, conical, unequal teeth; no teeth on vomer or palatines. Scales small, thin; lateral line running along the side of the belly, becoming median on the tail. No finlets. Dorsal fin more or less elevated anteriorly; caudal fin short, unequally lunated or forked; pectorals moderate; ventrals small, the latter inserted behind the middle of the body. Gill rakers obsolete. Bones usually more or less green. Size comparatively large. Species numerous. Voracious fishes, chiefly American; one species crossing to Europe; some of them entering rivers. This genus differs from the Old World genus *Esox*,* (Linnæus) Rafinesque, (=*Belone*, Cuvier), in the absence of gill rakers and of vomerine teeth. (*τύλος*, callus; *οὐρά*, tail; in allusion to the caudal keel, on which the genus was originally based, a character of little importance.)

*a.* Mouth capable of being nearly or quite closed, the upper jaw not conspicuously arched at base.
  *b.* Caudal peduncle compressed, deeper than broad, without trace of keel along the lateral line; dorsal and anal fins short, each of 13 to 16 rays, the posterior rays not elevated; anal longer than dorsal and inserted farther forward; jaws slender, about twice as long as rest of head; no fold of skin across preopercle; caudal subtruncate, the lower lobe somewhat produced; sides with a bluish-silvery band; species of small size, with the scales and bones not green.
    *c.* Scales comparatively large, about 85 before the dorsal fin, and about 7 or 8 rows on the cheeks; body robust, the depth about 5 in head; coloration pale, the dorsal and caudal brick red in life; lateral stripe narrow for its entire length; no scapular blotch. NOTATUS, 1049.
    *cc.* Scales small, 140 to 150 before dorsal fin, about 12 rows on the cheeks; body slender; ventrals inserted at a point nearer cheeks than base of caudal; fins without red; lateral stripe broadened below the dorsal fin.
      *d.* Region above base of pectorals with a conspicuous round blackish blotch. SCAPULARIS, 1050.
      *dd.* Region above base of pectorals without black spot.
        *e.* Body very slender, the depth 7 in head, which is $2\frac{5}{8}$ in body; eye moderate, $2\frac{1}{3}$ to $2\frac{3}{4}$ in postorbital part of head; no distinct notch in the temporal ridge; maxillary not entirely concealed by preorbital. D. 1, 15; A. 1, 17; scales in lateral line 225. TIMUCU, 1051.
        *ee.* Body less slender, the depth 6 in head, which is $2\frac{9}{10}$ in body; eye large, $2\frac{1}{5}$ in postorbital part of head; a distinct notch on temporal ridge close behind eye; maxillary almost entirely concealed by the preorbital. D. 1, 15; A. 1, 17; scales in lateral line 200. EURYOPS, 1052.
  *bb.* Caudal peduncle very much depressed, wider than deep, but without trace of keel. Head $2\frac{2}{3}$ in length; eye $2\frac{1}{2}$ in postorbital part of head; maxillary nearly concealed by preorbital; body subterete; snout very nearly twice length of rest of head; brownish above, silvery below, a bluish lateral stripe edged below with black and yellowish; scales not very small. D. 16; A. 17. DIPLOTÆNIA, 1053.
  *bbb.* Caudal peduncle more or less depressed, or, at least, with a more or less developed dermal keel along the lateral line; scales and bones more or less green.
    *f.* Dorsal and anal fins short, each of 14 to 19 rays, the anal larger than the dorsal and beginning farther forward; last rays of dorsal and anal low; jaws slender, about twice as long as rest of head; no fold of skin across preopercle.
      *g.* Eye very small, 4 to 5 in postorbital part of head; caudal keel sharp, color black; body and tail much depressed; teeth very small.
        *h.* Eye 5 in postorbital part of head; dorsal rays 14; A. 15. MICROPS, 1054.

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* From the original genus *Esox* of Linnæus, the groups called *Sphyræna*, *Synodus*, and *Lepisosteus* were detached by Lacépède as distinct genera in 1803. In 1810 the remaining species were divided by Rafinesque into two genera, *Lucius*, Rafinesque, typified by *Esox lucius*, Linnæus, and *Esox*, of which *Esox belone* was taken as the type. This restriction of the generic name *Esox*, being the earliest, must stand, and the name *Esox* must supersede *Belone*.

*hh.* Eye 4 in postorbital part of head; dorsal rays 16; anal 19. ANGUSTICEPS, 1055.

*gg.* Eye moderate, 2 to 3¼ times in postorbital part of head.

*i.* Caudal fin forked; caudal keel sharp, broad, and conspicuous; top of head flat, striated, without median groove; base of upper jaw much depressed; maxillary entirely hidden by preorbital; teeth very small; ventral fin midway between eye and caudal; scales not very small. D. 1, 13; A. 1, 18. ARDEOLA, 1056.

*ii.* Caudal fin unequally lunate, the emargination not deep, the lower rays moderately produced; scales very small; sides with a silvery lateral stripe; caudal keel not very conspicuous, not black; top of head with median groove; maxillary not entirely concealed by preorbital; ventral inserted midway between preopercle and base of caudal. Species of moderate size, with the scales and bones more or less green.

*j.* Body very slender, the depth 6½ to 7 in length of head; caudal keel not very small.

*k.* Posterior half of pectorals more or less abruptly black; eye large, 2½ in postorbital part of head. D. 1, 16; A. 1, 17; lateral line 250. SIERRITA, 1057.

*kk.* Posterior half of pectorals pale, like the base of the fin; eye rather small, 2¾ in postorbital part of head. D. 1, 15; A. 1, 17; lateral line 370. EXILIS, 1058.

*jj.* Body moderately slender, the depth 5½ in length of head; caudal keel little developed.

*l.* Eye moderate, 2½ in postorbital part of head; pectorals not black posteriorly. D. 1, 15; A. 1, 17; lateral line 300; a dark bar on opercle. MARINUS, 1059.

*ll.* Eye small, 3¼ in postorbital part of head. D. 13 or 14; A. 15 or 16; pectoral pale. ALMEIDA, 1060.

*ff.* Dorsal and anal fins long, each of 17 to 25 rays, the last rays of the dorsal fin more or less elevated in the young, becoming lower in the adult; caudal keel rather strong, black; one or more folds of skin across the edge of the preopercle; caudal fin deeply emarginate or unequally forked. Ventrals inserted midway between base of caudal and middle of eye. Species of large size, with the scales and bones green; no distinct lateral stripe.

*m.* Beak short and very strong, its length 1½ to 1⅚ times length of rest of head; body comparatively robust, the depth more than ⅕ length of head.

*n.* Dorsal fin of moderate length, its rays 1, 19; anal rays 1, 17; insertion of dorsal notably behind that of anal; snout very short, 1½ times length of rest of head; lateral line 440. FODIATOR, 1061.

*nn.* Dorsal fin long, its rays 1, 21 to 1, 24; anal rays 1, 22 to 1, 24; insertion of dorsal almost opposite that of anal; snout longer, 1⅔ to 1⅚ length of rest of head; lateral line about 350. RAPHIDOMA, 1062.

*nnn.* Allied to *T. raphidoma*, but insufficiently characterized. GALEATUS, 1063.

*mm.* Beak strong, but more elongate, its length about twice length of rest of head; dorsal beginning behind front of anal.

*o.* Greatest depth of body equal to length of pectoral; teeth shorter and weaker than in *T. acus.* D. 21 to 22; A. 19 or 20; a grayish lateral streak. PACIFICUS, 1064.

*oo.* Greatest depth of body about ⅔ length of pectoral. D. 1, 23; A. 1, 21; lateral line 380; no lateral stripe. ACUS, 1065.

*aa.* Mouth not closing completely, the upper jaw arched at base; lobes of dorsal and anal low, the last rays elevated; eye very large, 2⅒ in head; scales small, green. D. 24; A. 22; a bluish lateral band. CARIBBÆUS, 1066.

### 1049. TYLOSURUS NOTATUS (Poey).

(NEEDLE-FISH; LONG-JAWS.)

Head 2; depth 5. D. 13; A. 13;* scales large, 85 before dorsal, 150 in lateral line. Body robust, not compressed; tail posteriorly not compressed, deeper than broad, without keel, the lateral line not black. Head flat above, with deep, scaly median groove; maxillary hidden by the preorbital. Jaws long and slender, the upper from eye nearly twice rest of head; mouth closing completely. Teeth moderate, wide-set; scales and bones not green. Eye equal to interorbital space, 2¼ in postorbital part of head. Pectoral as long as postorbital part of head; ventrals very small, placed midway between axil and base of caudal; caudal slightly lunate, the lobes subequal. Color pale greenish, with silvery stripe; tips of vertical fins brick red in life. Length about 20 inches. West Indies, north to Pensacola, common about Key West; easily known by its few fin-rays. (*notatus*, marked.)

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* Counting developed rays only.

*Belone notata*, POEY, Memorias, II, 293, 1860, Havana; GÜNTHER, Cat., VI, 248, 1866; GOODE & BEAN, Proc. U. S. Nat. Mus., 1879, 151.

*Tylosurus notatus*, JORDAN & GILBERT, Synopsis, 373, 1883; JORDAN & FORDICE, Proc. U. S. Nat. Mus., 1886, 345.

### 1050. TYLOSURUS SCAPULARIS, Jordan & Gilbert.

Head 2⅘; depth 6⅔; eye 2½ in postorbital part of head. D. 14; A. 15; scales 215. Body slender, subterete. Caudal peduncle compressed, without keel; jaws slender, twice length of rest of head. Scales small, 145 to 150 before dorsal; maxillary not whollyconcealed by preorbital. Greenish; a bluish-silvery lateral band, which is broadened below dorsal; a conspicuous round, dark blotch above pectoral. Length 1½ feet. Panama; rather scarce. (*scapula*, shoulder, which has a dark spot.)

*Tylosurus scapularis*, JORDAN & GILBERT, Bull. U. S. Fish Comm., I, 1881, 307, Panama. (Type, Nos. 29427, 29435, and 29438. Coll. Gilbert.) *Ibid.*, II, 1882, 109; JORDAN, Proc. U. S. Nat. Mus., 1885, 370.

### 1051. TYLOSURUS TIMUCU (Walbaum).

(TIMUCU; PEIXE AGULHA.)

Head 2⅚; depth 7; eye moderate, 2⅓ to 2¾ in postorbital part of head. Scales small, 225, about 150 before dorsal. D. 15; A. 17. Body very slender, subterete; caudal peduncle not keeled; ventrals inserted nearer cheeks than base of caudal. No distinct temporal notch; maxillary not entirely concealed. Scales and bones not green. Greenish; a silvery-bluish lateral band, widened below dorsal; no scapular spot. Length 1½ feet. Florida Keys to Brazil; not rare; our specimens from Key West, Cuba, and Bahia.

*Timucu* or *Peixe agulha*, MARCGRAVE, Pisc. Brasil., 168, 1648, Brazil.

*Esox timucu*, WALBAUM, Artedi Pisc., III, 88, 1792, Brazil; after *Timucu* of MARCGRAVE.

*Belone subtruncata*, POEY, Memorias, II, 295, 1860, Havana.

*Belone depressa*, POEY, Memorias, , 296, 1860, Havana.

*Tylosurus sagitta*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1884, 25, Key West. (Type, No. 34965. Coll. Jordan.)

*Tylosurus subtruncatus*, JORDAN & FORDICE, *l. c.*, 346.

### 1052. TYLOSURUS EURYOPS, Bean & Dresel.

(LONG-JAW.)

D. 15; A. 17; scales 200. Close to *Tylosurus timucu*, but the body less slender, the depth 6 in head, which is about 3 in body; eye larger, 2⅕ in postorbital part of head; a distinct notch on temporal ridge close behind eye; maxillary almost entirely concealed by preorbital. Cuba and Jamaica. (εὐρύς, wide; ὤψ, eye.)

*Tylosurus euryops*, Bean & Dresel, Proc. U. S. Nat. Mus., 1884, 168, Jamaica. (Type, No. 32073. Coll. Public Museum of the Institute of Jamaica.) Jordan, Proc. U. S. Nat. Mus., 1886, 35.

### 1053. TYLOSURUS DIPLOTÆNIA (Cope).

Head 2⅔; eye 2½ in postorbital part of head. D. 16; A. 17. Body subterete; caudal peduncle very much depressed, wider than deep, but without trace of keel; maxillary nearly concealed by preorbital; top of head nearly smooth. Caudal moderately emarginate; snout nearly twice length of rest of head; scales not very small, 23 rows between dorsal and anal. Brownish above, silvery below, a bluish lateral stripe edged below with black and yellowish. St. Martin Island, West Indies. (Cope); not seen by us. (διπλόος, double; ταινία, ribbon or stripe.)

*Belone diplotænia*, Cope, Trans. Amer. Phil. Soc. Phila., 1871, 481, St. Martin Island, West Indies.

### 1054. TYLOSURUS MICROPS (Günther).

Head 3. D. 13 to 15; A. 14 or 15. Tail strongly depressed, with a sharpish edge, which is posteriorly black. Body depressed, rather broader than deep. Upper surface of head flat, smooth, with a narrow median groove; superciliary region quite smooth; base of premaxillaries depressed; maxillary half hidden by the preorbital. Teeth of moderate size, widely set; vomerine teeth none. Diameter of eye little more than width of interorbital space and ⅕ length of postorbital portion of head, which is rather more than half length of beak. Depth of body considerably less than length of pectoral fin, which is less than the distance of the opercular margin from the orbit; ventral fin a little nearer head than caudal; middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a considerable distance from root of caudal; origin of anal somewhat in advance of that of dorsal; caudal forked, with the lobes subequal in length. Scales minute, adherent. The termination of the lateral keel on the caudal fin black. Coast of Guiana. (Günther.) (μικρός, small; ὤψ, eye.)

*Belone microps*, Günther, Cat., vi, 237, 1866, Surinam, British Guiana. (Coll. Sir R. Schomburgk.)

### 1055. TYLOSURUS ANGUSTICEPS (Günther.)

Head 2⅘. D. 16; A. 19. Tail strongly depressed, with a sharpish lateral edge; body subcylindrical. Head narrow, elongate, rather convex above, with a deep, median longitudinal groove. Base of the intermaxillaries depressed; teeth very small; maxillary half hidden by the preorbital. Eye ¼ length of postorbital part of head, which is more than that of pectoral. Ventral somewhat nearer to head than caudal; middle and hinder dorsal and anal rays subequal in length, short, the last terminating at a considerable distance from root of caudal; caudal fin somewhat emarginate. Scales very small. Termination of the caudal keel blackish. Coast of Ecuador. (Günther.) (*angustus*, narrow; *-ceps*, head.)

*Belone angusticeps*, Günther, Cat., vi, 238, 1866, Ecuador. (Coll. Fraser.)

### 1056. TYLOSURUS ARDEOLA (Cuvier & Valenciennes).

D. 13; A. 18. Caudal peduncle depressed and with a sharp keel; scales and bones green; eye moderate; top of head striated; teeth very small; base of upper jaw much depressed; maxillary entirely hidden; caudal fin forked; ventral midway between eye and caudal. West Indies. (Günther, as "*Belone depressa*"); not seen by us. The synonymy below is all more or less doubtful. (*Ardeola*, diminutive of *Ardea*, heron.)

? *Belone ardeola*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVIII, 425, 1846, Martinique.
? *Belone cigonella*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVIII, 436, 1846, Porto Rico.
? *Belone argalus*, LE SUEUR MS. in CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVIII, 439, 1846, Guadeloupe.
*Belone depressa*, GÜNTHER, Cat., VI, 235, 1866; not of POEY.

### 1057. TYLOSURUS STOLZMANNI (Steindachner).

(SIERRITA.)

Head 2⅘; depth nearly 18; eye large, about 10½ in head or about 3 in postorbital part. D. I, 16; A. I, 17; P. 13; scales about 250. Body very slender, not compressed; caudal peduncle depressed, half wider than deep, the lateral line forming a moderate keel, which is green. Jaws very long, slender, and fragile, the tip of the lower projecting; length of upper jaw from eye 2¾ times length of postorbital part of head, or 9 times space between nostrils; maxillary scarcely reaching vertical from front of pupil, about half of its posterior portion slipping under the preorbital, which is small, not reaching backward to tip of maxillary. Scales larger than in *T. exilis*. Interorbital region with a rather broad and deep scaly groove, widest anteriorly and extending backward to opposite middle of cheeks; behind this the middle part of cranium somewhat elevated and bounded by two longitudinal ridges higher than the temporal ones; this region scaleless. Cheeks well scaled; scales on opercle very minute. Dorsal origin above base of fifth anal ray; anterior rays of both fins produced; other rays equal, the posterior not reaching nearly to base of caudal; anal lobe higher than dorsal lobe, its length ⅘ postorbital part of head; ventrals small, extending about ⅓ distance to origin of anal, their insertion midway between base of middle caudal rays and middle of cheek; pectorals broad, as long as postorbital part of head, the upper ray broad; caudal lunate, lower lobe longer. Color green above, white below; a dusky dorsal stripe and a silvery lateral one; sides of head silvery, upper part of cheek punctulate, a blackish half bar between cheek and opercle; a blackish blotch above eye and one in front of nostrils; fins olivaceous, somewhat dusky at tip; posterior part of pectoral more or less abruptly black, sometimes merely dusky; caudal keel green.* Length 2 feet. Abundant at Mazatlan, where it is a common market fish; also taken at Guaymas by Evermann and Jenkins; south to Peru.

*Belone stolzmanni*, STEINDACHNER, Ichth. Beitr., VII, 21, 1878, Tumbez, Peru.
*Tylosurus sierrita*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1881, 458, Mazatlan. (Type, Nos. 28162, 28265, 29227, 29377, and 29378. Coll. Gilbert.)

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* This description is drawn up from Mazatlan specimens, including the types of *T. sierrita*. Steindachner's types of *B. stolzmanni* are described as having a smaller eye (14 in head instead of 10½), the pectorals merely dusky, and D. 15; A. 16.

### 1058. TYLOSURUS EXILIS (Girard).

(Needlefish.)

Head 2⅘; depth 7 in head. D. 15; A. 17; scales 370. Body very slender; tail very slender, broader than long, with a moderate keel, pale in color; head long, the upper jaw from eye twice rest of head. Eye moderate, 2¾ in postorbital region. Maxillary not nearly all hidden by the narrow preorbital. Top of head flattish, with a broad scaly groove. Pectoral fin 1⅙ in postorbital part of head; ventrals short, midway between preopercle and base of caudal; dorsal and anal falcate, rather low, the anal beginning before dorsal; caudal fin slightly and unequally lunate. Translucent green, silvery below; an olivaceous vertebral streak and a bluish lateral band; fins plain, olivaceous, the pectoral without black. Scales very small and thin, 280 before dorsal. Length 3 feet. Coast of southern California, from Point Concepcion southward to Cerros Island; abundant; rarely used as food on account of the "green backbone." Close to *Tylosurus marinus*, the body more slender. (*exilis*, slender.)

*Belone exilis*, Girard, Proc. Ac. Nat. Sci. Phila., 1854, 149, San Diego (Coll. A. Cassidy); Girard, Pac. R. R. Surv., Fish., 158, 1858; Günther, Cat., vi, 238, 1866.
*Tylosurus exilis*, Jordan & Gilbert, Synopsis, 374, 1883; Jordan & Fordice, *l. c.*, 349.

### 1059. TYLOSURUS MARINUS (Walbaum).

(Garfish; Billfish; Needlefish; Agujon.)

Head 2⅘; depth 5½; snout 4½. Eye large, 2½ in postorbital part of head. D. 15; A. 17; vertebræ 44 + 24 = 68; scales 300. Body slender, not compressed; tail moderately depressed, broader than deep, the lateral line passing into a slight keel which is not black. Head long, flat above, with a broad, rather shallow, scaly median groove. Upper jaw from eye twice length of rest of head; maxillary not nearly hidden by the preorbital. Teeth sharp; mouth not quite closing. Scales and bones more or less green; pectoral equal to postorbital part of head. Ventrals moderate, midway between preopercle and base of caudal; dorsal and anal somewhat falcate; the last rays always short; caudal fin slightly emarginate. Scales thin and small, 240 before dorsal. Color greenish, sides silvery; a narrow silvery lateral stripe; a dark bar on front of opercle; fins olivaceous. Length 4 feet. Cape Cod to Texas; very abundant on our Atlantic and Gulf coasts; often ascending rivers far above tide water, and doubtless breeding in fresh waters. (*marinus*, of the sea.)

*Sea Snipe*, Schöpf, Gesellsch. Naturforschende Freunde, 177, 1788, Long Island.
*Esox marinus*, Walbaum, Artedi Piscium, iii, 88, 1792; after Schöpf.
*Esox belone*, var. *marinus*, Bloch & Schneider, Syst. Ichth., 391, 1801; after Schöpf.
*Esox longirostris*, Mitchill, Amer. Month. Mag., ii, 1818, 322, Hudson River.
*Belone truncata*, Le Sueur, Journ. Ac. Nat. Sci. Phila., ii, 1821, 126, New York Bay; Günther, Cat., vi, 244, 1866.
*Belone scrutator*, Girard, U. S. Mex. Bound. Surv., Ichth., 30, pl. 13, 1859, Brazos Santiago, and St. Joseph Island, Texas. (Colls. John H. Clark and Gustav Würdemann.)
*Tylosurus longirostris*, Jordan & Gilbert, Synopsis, 374, 1883.
*Tylosurus marinus*, Jordan & Fordice, *l. c.*, 351.

### 1060. TYLOSURUS ALMEIDA (Quoy & Gaimard).

(TIMUCU.)

Head about 3. D. 13 or 14; A. 15 or 16. Very close to *Tylosurus marinus*, but with smaller eye, 3 to 3½ in postorbital part of head, and fewer fin rays. Surinam to Rio de Janeiro, and probably northward in the West Indies. Known to us from the specimens called *Belone timucu* by Cuvier & Valenciennes. (Named for Don Fr. Almeida, once Secretary of the Portuguese legation at Paris.)

*Belone almeida*, QUOY & GAIMARD, Voyage de l'Uranie, Zoöl., 226, 1824, Brazil.

*Belone timucu*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVIII, 426, 1846, Rio de Janeiro; not *Esox timucu* of WALBAUM.

*Belone truncata*, var. *guianensis*, GÜNTHER, Cat., VI, 245, 1866; not of MÜLLER & TROSCHEL.

### 1061. TYLOSURUS FODIATOR, Jordan & Gilbert.

(AGUJON.)

Head about 3⅔; depth 15; eye large, 6½ in snout, 3 in postorbital part of head, and 2 in interorbital width. D. I, 19; A. I, 17; V. 6; P. 14; scales 440. Body robust, the caudal peduncle with a strong keel, black in color; one or more folds of skin across edge of preopercle; caudal unequally forked; dorsal with its last rays elevated in the young. Beak short and very strong, the snout 1½ times length of rest of head. Dorsal inserted opposite anal; ventrals inserted midway between base of caudal and middle of eye. Cheeks closely scaled, opercles nearly naked; scales extremely small. Color green above, silvery below; fins somewhat dusky, except the anal, which is pale; cheeks and lower jaw silvery; middle line of back darker; scales and bones a very bright green; no distinct lateral stripe. Length 3 to 5 feet. Pacific coast of Mexico; common about Mazatlan and Acapulco. A very robust species, distinguished from *T. raphidoma* by its fewer fin rays. (*fodiator*, one who stabs, this species, like the next, being often dangerous to fishermen.)

*Tylosurus fodiator*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1881, 459, Mazatlan. (Type, Nos. 28190 and 28323. Coll. Gilbert.) JORDAN, Cat. Fishes N. A., 59, 1885.

### 1062. TYLOSURUS RAPHIDOMA (Ranzani).

(HOUNDFISH; AGUJA DE CASTA; GUARDFISH.)

D. 21 to 24; A. 22 to 24; scales 350. Caudal keel rather strong, black; one or more folds of skin across edge of preopercle. Body robust, little compressed, its greatest breadth a little more than ⅔ greatest depth; caudal peduncle slightly depressed, a little broader than deep, with a slight black dermal keel. Head broad, interorbital space nearly ⅔ length of postorbital part of head, with a broad, shallow, nearly naked median groove, which is wider behind and forks at the nape. Supraorbital bones with radiating striæ. Jaws unusually short, stiff, strong, rapidly tapering forward; large teeth of jaws very strong, knife-shaped. Upper jaw from eye about 1¾ times as long as the rest of head. Eye large, 7 in snout, 2⅔ in postorbital part of head, and 1⅘ in interorbital width. Maxillary entirely covered by the preorbital. Cheeks densely scaled; opercles mostly naked except along the anterior margin. Scales of body minute, especially above. Dorsal fin low posteriorly; the height of its anterior lobe equaling that of anal, or length of postorbital part of head; its longest ray ⅖ the base of the fin; last rays of dorsal and anal much elevated in young; caudal lunate, its lower lobe nearly half longer than the upper; middle rays about as long as eye. Ventrals inserted midway between base of caudal and middle of eye, their length a little less than that of pectoral, and equal to postorbital part of head; insertion of anal opposite that of dorsal. Color green, silvery below; no lateral stripe; pectorals and dorsal blackish. Scales and bones green. Length 3 to 5 feet. West Indies, Florida Keys to Brazil; generally abundant; a large, vigorous species, occasionally becoming dangerous in its leaps from the water. The young occasionally northward (Ocean City, New Jersey—Bean). (*ῥαφίς*, *rhaphis*, a sharp instrument; an old name of the pike.)

*Belone raphidoma*, Ranzani, Nov. Comm. Ac. Nat. Sci. Inst. Bonon., v, 1842, 359, pl. 37, fig. 1, Brazil; Günther, Cat., vi, 249, 1866.

*Belone gerania*, Cuvier & Valenciennes, Hist. Nat. Poiss., xviii, 437, 1846, Martinique; Günther, Cat., vi, 241, 1866.

*Belone crassa*, Poey, Memorias, ii, 291, 1861, Cuba.

*Belone melanochira*, Poey, Memorias, ii, 294, 1861, Havana; Günther, Cat., vi, 249, 1866.

*Tylosurus gladius*, Bean, Proc. U. S. Nat. Mus., 1882, 239, 430, Pensacola. (Type, No. 30151. Coll. Stearns.) Jordan & Gilbert, Synopsis, 901, 1883.

*Tylosurus raphidoma*, Jordan, Proc. U. S. Nat. Mus., 1886, 35; Jordan & Fordice, *l. c.*, 353.

*Tylosurus crassus*, Jordan, Proc. U. S. Nat. Mus., 1884, 112.

### 1063. TYLOSURUS GALEATUS (Cuvier & Valenciennes).

D. 15; A. 17. An imperfectly known species, apparently differing from *T. raphidoma* in having the caudal little forked and in having no caudal keel. Scales small. Beak rather strong, 1⅔ times length of rest of head. Top of head with a bony casque, its surface smooth; its borders with notches like those on a violin. Cayenne. (Cuvier & Valenciennes.) (*galeatus*, having a helmet.)

*Belone galeata*, Cuvier & Valenciennes, Hist. Nat. Poiss., xviii, 429, 1846, Cayenne.

### 1064. TYLOSURUS PACIFICUS (Steindachner).

D. 21 to 22; A. 19 or 20. Closely allied to *Tylosurus acus*, the teeth shorter and weaker, the greatest depth of body equal to length of pectoral. A grayish lateral streak. Acapulco to Panama; a large species; not common.

*Belone pacifica*, Steindachner, Ichth. Beitr., iii, 65, 1875, Panama; Acapulco.

*Tylosurus pacificus*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 624.

### 1065. TYLOSURUS ACUS (Lacépède).

(Houndfish; Agujon.)

D. 23; A. 21; scales 380. Caudal keel strong, black; 1 or more folds of skin across the preopercle; scales and bones green. Beak strong, more elongate than in *Tylosurus raphidoma*, its length about twice that of rest of head; greatest depth of body about ⅔ length of pectoral. Dorsal fin long, beginning behind front of anal, its last rays much elevated in the young, becoming low in the adult; caudal deeply and unequally emarginate; ventrals inserted midway between middle of eye and base of caudal. Green above; no lateral band. Length 3 to 4 feet. West Indies, occasionally straying northward (Buzzard's Bay, Goode; Beaufort, N. C., Jordan); also in the Mediterranean, if *Tylosurus imperialis*, Cocco, is the same species, as appears to be the case. (*Acus*, the needlefish, from *acus*, needle.) (Eu.)

*Sphyræna acus*, LACÉPÈDE, Hist. Nat. Poiss., v, 6, pl. 1, fig. 3, 1803, Martinique; from a drawing by PLUMIER.
? *Esox imperialis*, RAFINESQUE, Caratteri di Alcuni Nuovi Generi, 59, 1810, Palermo.
? *Tylosurus cantrainii*, COCCO, Lettere in Giorn. Sci. Lett. Sic., XVIII, 18, pl. 1, fig. 4, 1829, Messina; GÜNTHER, Cat., VI, 242, 1866.
*Belone latimana*, POEY, Memorias, II, 290, 1861, Havana; GÜNTHER, Cat., VI, 249, 1866; copied.
*Belone jonesi*, GOODE, Amer. Journ. Sci. Arts, 1877, 295, Bermuda; GÜNTHER, Ann. Mag. Nat. Hist., III, 1879, 150.
*Belone caribbæa*, GÜNTHER, Cat., VI, 241, 1866; not of LE SUEUR.
*Tylosurus acus*, JORDAN & FORDICE, *l. c.*, 355.

### 1066. TYLOSURUS CARIBBÆUS (Le Sueur).

D. 24; A. 22. Mouth not capable of being completely closed, the upper jaw being arched at base, much as in *Athlennes hians*; lobes of dorsal and anal low, the last rays elevated. Depth 20 in total length with caudal; head $3\frac{2}{5}$; body broad, compressed; breadth of body $\frac{2}{3}$ its depth, which is about equal to postorbital part of head; preopercle with folds of skin; eye very large, $10\frac{1}{3}$ in head, $2\frac{1}{10}$ in postorbital part; beak slender, more than twice as long as rest of head; teeth rather weak; preopercle with 2 cross folds of skin; caudal peduncle with a strong, black keel; caudal fin moderately forked, the lower lobe much the longer; dorsal inserted a little behind anal; ventrals midway between base of caudal and middle of eye; skull narrow. Scales small, green, about 210 before dorsal. Bluish white below, a faint bluish band along sides; fins bluish. West Indies; not very common.

*Belone caribbæa*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., II, 1821, 127, Caribbean Sea.
*Belone altipinna*, POEY, Memorias, II, 293, 1861, Cuba.
*Tylosurus caribbæus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVIII, 430, 1846.
*Tylosurus caribbæus*, JORDAN & FORDICE, *l. c.*, 357.

## 325. ATHLENNES,* Jordan & Fordice.

*Athlennes*, JORDAN & FORDICE, Proc. U. S. Nat. Mus., 1886, 342, (*hians*).

This genus is close to *Tylosurus*, differing chiefly in the greatly compressed, almost ribbon-shaped body. The single species is American. (ἀβλεννής, without mucosity, a name applied by some mediæval authors to the fish called by them βελόνη or *Acus*, *Esox belone*, L.)

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* This name was inadvertently written "*Athlennes*" by its authors, and as this form has now been several times used it may remain so. *Ablennes* was intended, as the etymology shows; *Athlennes* is meaningless, but euphonious.

### 1067. ATHLENNES HIANS (Cuvier & Valenciennes).

D. 25; A. 26. Scales about 520. Body very strongly compressed, its greatest breadth not half its greatest depth; caudal peduncle not compressed, without keel; jaws long and very slender, the upper strongly arched upward at base, so that the mouth can not be closed; snout twice length of rest of head; eye large, 2½ in postorbital part of head; maxillary entirely concealed by preorbital; a fold of skin across preopercle; opercle smooth; insertion of ventrals well forward, midway between front of arch of upper jaw and base of caudal; caudal deeply forked; dorsal and anal falcate, the latter beginning farther forward; pectorals long, falcate; scales minute; with scales and bones green; no lateral band; sides silvery, with round, dark blotches in young; fins with black tips. Length 3 feet. West Indies, ranging from Florida to Brazil; generally common. Also recorded by Steindachner from Acapulco, but the Pacific species of *Athlennes* (not seen by us) may prove to be different. (*hians*, gaping.)

*Belone hians*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVIII, 432, 1846, Havana; Bahia; GÜNTHER, Cat., VI, 248, 1866; COPE, Trans. Am. Philos. Soc., 1871, 481; STEINDACHNER, Ichth. Beitr., III, 64, 1875.

*Belone maculata*, POEY, Memorias, II, 290, 1861, Havana.

*Tylosurus hians*, JORDAN & GILBERT, Synopsis, 373, 901, 1883.

## Family XCV. HEMIRAMPHIDÆ.

### (THE BALAOS.)

Body elongate, more or less compressed, covered with large cycloid scales; upper jaw short, lower jaw various, sometimes much produced, the toothed portion at base fitting against the toothed premaxillaries; teeth equal, mostly small and tricuspid; maxillaries anchylosed to premaxillaries. Gill rakers long. Caudal fin rounded, or forked; if forked, the lower lobe the longer. Anal fin modified in the viviparous species (*Zenarchopterus*), unmodified in the others and usually similar to the dorsal; no finlets; air bladder large, sometimes cellular. Third upper pharyngeal on each side much enlarged, solidly* united with its fellow to form an oval plate, with slightly convex surface and covered with blunt tricuspid teeth; this is about as large as the united lower pharyngeals and fits into the concavity of the latter; fourth upper pharyngeal wanting or grown fast to the third; lower pharyngeal large, thick, triangular, with concave surface. Vertebræ about 50. (Characters verified in *Hemiramphus browni*, *Hyporhamphus roberti* and *Chriodorus atherinoides.*)

Herbivorous fishes of the warm seas; mostly shore species; a few pelagic. They feed chiefly on green algæ, and, like the related forms, swim at the surface, occasionally leaping into the air. Size rather small, about a foot in length. Genera about 7; species about 75. (*Scombresocidæ*, part, Günther, Cat., VI, 259–276, 1866.)

*a.* Lower jaw bluntish, not at all produced; teeth rather large; pectorals and ventrals moderate; shore fishes. CHRIODORUS, 326.

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* A singular character, first noticed by Mr. Edwin C. Starks.

*aa.* Lower jaw acute, longer than upper, or more or less produced; teeth small; species oviparous, the anal fin in the male not modified, the caudal fin unequally lunate.
  *b.* Lower jaw produced in a long pointed beak, usually longer than rest of head.
    *c.* Body moderately compressed; pectorals moderate; shore fishes.
      *d.* Air bladder simple; sides of body more or less convex; ventrals inserted anteriorly, far in advance of dorsal. HYPORHAMPHUS, 327.
      *dd.* Air bladder cellular; sides of body nearly vertical and parallel; ventrals inserted posteriorly, not far before dorsal. HEMIRAMPHUS, 328.
    *cc.* Body very slender and compressed, more or less band-like; pectoral fins very long, ventral very short, inserted posteriorly; pelagic species. EULEPTORHAMPHUS, 329.

## 326. CHRIODORUS, Goode & Bean.

(HARDHEADS.)

*Chriodorus*, GOODE & BEAN, Proc. U. S. Nat. Mus., 1882, 432, (*atherinoides*).

Body and fins essentially as in *Hemiramphus*, but both jaws very short, not at all produced, the lower jaw broadly rounded, each with two series of large, tricuspid, incisor teeth, which form a continuous cutting edge. Maxillary anchylosed to premaxillary. Pectorals small; ventral fins small, median. Scales large. Pharyngeal bones almost exactly as in *Hyporhamphus*, the lower pharyngeal a little thicker and less concave, the united third upper pharyngeals a little broader and less pointed forward. Vertebræ 49. Shore fishes, the single known species from the coast of Florida. (*χρεία*, want; *δόρυ*, lance; the jaw being not produced.)

### 1068. CHRIODORUS ATHERINOIDES, Goode & Bean.

(HARDHEAD.)

Head $4\frac{3}{5}$; depth $6\frac{3}{4}$; breadth of body $\frac{3}{5}$ its depth. D. 14 to 16; A. 15; V. 6; P. 12; scales 7–46 to 48–3; vertebræ $31+18=49$. Interorbital space broad, unevenly convex, its width equal to eye, which is $3\frac{5}{6}$ in head; snout 3 in head; premaxillaries much broader than long, their edges concave; maxillary 4 in head; mandible $2\frac{1}{4}$, its tip broadly rounded, not at all produced. Dorsal opposite anal and entirely similar to it; both fins elevated in front, but not falcate, their longest rays half head; caudal moderate, deeply and subequally forked; ventrals $2\frac{1}{6}$ in head, their insertion midway between snout and base of caudal; pectorals $1\frac{1}{2}$ in head; vertical fins with small scales. Bones of top of head smooth, hard, and translucent. Scales moderate, firm. Translucent greenish above with dark dots on the scales; a bright silvery lateral band as in *Atherina*, broadest under dorsal fin, where it is as wide as pupil. Length 10 inches. Florida Keys, locally abundant at Key West, but not yet taken elsewhere; a handsome little fish, and an excellent pan-fish. It feeds chiefly on green algæ. (*Atherina*; *εἶδος*, resemblance.)

*Chriodorus atherinoides*, GOODE & BEAN, Proc. U. S. Nat. Mus., 1882, 432, Key West; (Type, No. 26593. Coll. Stearns.) JORDAN & GILBERT, Synopsis, 903, 1883.

## 327. HYPORHAMPHUS, Gill.

(HALFBEAKS.)

*Hyporhamphus*, GILL, Proc. Ac. Nat. Sci. Phila., 1859, 131, (*tricuspidatus* = *unifasciatus*).

Body elongate, moderately compressed, the sides of body not vertical, but more or less convex; the dorsal outline parallel with that of the belly. Upper jaw short; lower jaw prolonged into a slender beak, bordered with membrane; this beak shorter in the young; premaxillaries forming a triangular plate, the teeth of which fit against the toothed portion of the mandible; maxillaries joined to premaxillaries. Teeth feeble, mostly tricuspid. Gill rakers rather long. Head covered above with large, shield-like scales. Scales large, deciduous. No finlets; caudal fin more or less forked, the lower lobe the longer; dorsal and anal similar, opposite each other, not modified in the males; last ray of dorsal usually short; ventrals small, inserted well forward, nearly midway between opercle and base of caudal. Oviparous. Air bladder large, simple, not cellular. Young with the lower jaw short. Sides in our species with a distinct silvery band, as in *Atherina*. Species numerous, in all warm seas, going in large schools, but usually remaining near shore, feeding chiefly on green algæ. Size comparatively small. (*ὑπό*, below; *ῥάμφος*, beak.)

*a.* Ventrals inserted about midway between posterior margin of eye and base of caudal; dorsal and anal scaly; scales 53 to 56.
  *b.* Length of mandible from tip of upper jaw less than rest of head in adult; (longer in young); body rather stout; D. 15; A. 16. UNIFASCIATUS, 1069.
  *bb.* Length of mandible from tip of upper jaw not less than rest of head, at all ages; much greater in adult; body more slender. D. 14; A. 15. ROBERTI, 1070.
*aa.* Ventrals inserted at a point nearly midway between gill opening and base of caudal; dorsal and anal with very caducous scales or none; scales 63 in a longitudinal series. D. 14; A. 14; form rather slender; beak longer than rest of head. ROSÆ, 1071.

### 1069. HYPORHAMPHUS UNIFASCIATUS (Ranzani).

(ESCRIBANO.)

Head $4\frac{5}{6}$; depth about $6\frac{1}{2}$. D. 12 to 14; A. 15; scales 52; vertebræ 34 + 18 = 52. Very close to *H. roberti*, differing chiefly in the shorter beak and the less compressed and more robust body. Lower jaw from end of upper jaw 6 to 7 in total length from its tip to base of caudal ($4\frac{1}{4}$ in *H. roberti*), its length in adult always less than that of rest of head; young with the beak proportionately longer; head with lower jaw 3 in body; body half deeper than broad; premaxillary plate broader than long; eye less than interorbital width, $\frac{3}{5}$ postorbital part of head; ventrals midway between eye and base of caudal; dorsal and anal densely scaly; back broad. Length 1 foot. West Indian fauna, generally common from Key West to Rio de Janeiro; also taken at Panama; this or some very similar species also in the East Indies and on the coast of Africa. The young of this species has the beak longer and can not always be readily distinguished from *Hyporhamphus roberti*, which is, however, always more slender; here described from Key West specimens. (*unus*, one; *fascia*, band.)

*Hemirhamphus unifasciatus*, RANZANI, Nov. Comm. Ac. Sci. Bonon., v, 1842, 326, Brazil; GÜNTHER, Cat., VI, 262, 1866; MEEK & GOSS, Proc. Ac. Nat. Sci. Phila., 1884, 222.
? *Hemirhamphus picarti*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XIX, 25, 1846, Algiers.
*Hemirhamphus richardi*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XIX, 26, 1846, Antilles; Cayenne; Bahia; Rio de Janeiro.
*Hyporhamphus tricuspidatus*, GILL, Proc. Ac. Nat. Sci. Phila., 1859, 131, Barbadoes.
*Hemirhamphus fasciatus*, POEY, Memorias, II, 299, 1861, Cuba; not of BLEEKER.
*Hemirhamphus poeyi*, GÜNTHER, Cat., VI, 262, 1866; after POEY.

### 1070. HYPORHAMPHUS ROBERTI (Cuvier & Valenciennes).

(Common Halfbeak; Pajarito.)

Head 4⅛ without, or 2¼ with mandible; depth about 7½. D. 14 to 16; A. 15 to 17; scales 54; vertebræ 34 + 17 = 51. Lower jaw (from front of eye) 4 to 4⅛ in length from tip of snout to base of caudal. Premaxillary plate rather broader than long; eye 3¾ to 4 in head, nearly equal to interorbital space, 1½ in postorbital part of head. Ventrals inserted nearly midway between eye and base of caudal; dorsal and anal scaly, opposite each other and similar in form; caudal moderately forked, the middle rays half longer than the eye. Back rounded above. Translucent green above; the scales above dark-edged; sides with a well-defined silvery band, narrower than the eye, about as broad as a scale; tip of lower jaw red; 3 narrow dark streaks along middle of back; anterior rays of dorsal and anal and tips of caudal usually dusky, sometimes jet black, especially in Pacific Coast examples, which have darker fins than those from the Atlantic. Peritoneum black, as in most herbivorous fishes. An excellent food-fish. Length 12 inches. Coasts of America on sandy shores, swimming in schools, and often pursued by the bluefish and other predatory species; on the Atlantic Coast it is found chiefly north of the Tropic of Cancer, but extending to the Equator on the Pacific Coast. Very close to the preceding, of which it may be a northern variety or subspecies. It is recorded from Newport, R. I., Longport and Beesleys Point, N. J., Beaufort, N. C., Charleston, Pensacola, San Sebastian River, Cedar Keys, New Orleans, Mazatlan, Guaymas, Cape San Lucas, La Paz, Panama, and Indefatigable Islands and Chatham of the Galapagos. It seems to be common on both coasts, especially in northern Florida, and about Cape San Lucas. It has not been found among the Florida Keys or in Cuba. On the Pacific Coast its range is not limited to the region outside the Tropics. This species has been called *Hemiramphus roberti*, but as the type came from Cayenne, the scanty description may have been based on a specimen of *H. unifasciatus*. As type of our present description, we take a specimen from Indefatigable Island. (Named for M. Robert, who collected at Cayenne for Valenciennes.)

*Hemirhamphus roberti*, Cuvier & Valenciennes, Hist. Nat. Poiss., xix, 24, 1846, Cayenne; said to have a longer beak than *H. picarti*; possibly based on specimens of *H. unifasciatus*; (Coll. Poiteau & Robert); Günther, Cat., vi, 263, 1866; Meek & Goss, Proc. Ac. Nat. Sci. Phila., 1884, 223.

*Hemirhamphus unifasciatus*, Jordan & Gilbert, Synopsis, 376, 1883.

### 1071. HYPORHAMPHUS ROSÆ (Jordan & Gilbert).

Head 2 with lower jaw, or 5 with upper; length of lower jaw beyond the upper 4½ in head. D. 14; A. 14; scales 61 to 63. Lower jaw (from tip of upper) 4½ in length from its tip to base of caudal. Head without mandible 3⅘ in length from tip of upper jaw. Premaxillary plate about as broad as long. Eye less than interorbital space, about half postorbital part of head. Ventrals inserted farther back than in *H. roberti*, rather nearer tip of caudal than eye, a very little nearer gill opening than base of caudal. Scales very easily detached, the dorsal and anal fins apparently not scaly. Caudal moderately forked, the middle rays being twice the length of the eye; pectorals shorter than postorbital part of head; ventrals a little shorter. Back broad. Green, with a silvery lateral band, rather broader than a scale; a triple vertebral streak; lower jaw dark reddish brown; fins plain. Southern California and southward in sheltered bays, the young and half grown frequently taken at San Diego; the adult found in abundance in brackish or fresh-water lagoons farther south. (Named for Rosa Smith, now Mrs. Eigenmann, then of San Diego, the first woman to discover and describe new species of fishes.)

*Hemirhamphus rosæ*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1880, 335, San Diego, California; (Coll. Jordan & Gilbert); JORDAN & GILBERT, Synopsis, 376, 1883.

## 328. HEMIRAMPHUS, Cuvier.

(BALAOS.)

*Hemirhamphus*, CUVIER, Règne Animal, Ed. I, II, 1817, (*brasiliensis* = *browni*).
*Hemirhamphus*, or *Hemirrhamphus*, corrected spelling.

Body more robust than in *Hyporhamphus* and different in form, the sides of body being compressed and nearly vertical and parallel. Head and jaws as in *Hyporhamphus*. Dorsal longer than anal fin and inserted farther forward, its last ray more or less produced in American species. Ventral fins small and inserted well backward, much nearer base of caudal than gill opening. Air bladder cellular, with many partitions (in *H. browni*). Species probably numerous, but most of them have not been examined as to the characters which separate this genus from *Hyporhamphus*. (ἡμι, half; ῥάμφος, beak.)

*a.* Upper lobe of pectoral orange in life; length of pectoral scarcely greater than depth of body. D. 14; A. 12; scales 53. BRASILIENSIS, 1072.
*aa.* Upper lobe of caudal dull bluish in life; scales rather smaller; length of pectoral $\frac{1}{3}$ greater than depth of body BALAO, 1073.

### 1072. HEMIRAMPHUS BRASILIENSIS (Linnæus).

(BALAÓ; ESCRIBANO.)

Head (with lower jaw) $2\frac{3}{4}$; depth $6\frac{2}{3}$. D. 14; A. 12; scales 53. Body not very slender, compressed, "slab-sided," the sides of body vertical, and parallel with each other. Lower jaw (from end of upper jaw) $4\frac{2}{5}$ in length from its tip to base of caudal. Head, without mandible, 5 in length from tip of upper jaw. Premaxillaries broader than long. Eye large, equal to interorbital space, $\frac{2}{3}$ postorbital part of head. Ventrals inserted well backward, midway between base of caudal and middle of pectoral; vertical fins scaly; anal much smaller than dorsal; last ray of dorsal produced in a short filament; pectoral $\frac{3}{4}$ length of head, its length a little more than depth of body; ventrals $2\frac{3}{4}$ in head; caudal deeply forked, the lower lobe longest. Color in life clear deep blue green, much darker than in *Hyporhamphus unifasciatus*; sides silvery, without lateral band; beak dark, its tip bright orange, its membrane edged with white;

lobe of dorsal and upper lobe of caudal deep orange yellow; ventrals tipped with yellow; sexes alike. Length 15 inches. West Indies, generally abundant from Key West southward to Bahia; this or some closely related species also occurring at Panama. Common at Key West and Havana; a specimen taken at Hunger's Wharf, Virginia, by Dr. J. T. Wilkins; a good food-fish, well distinguished by its orange caudal fin.

*Esox maxilla inferiore producta*, BROWNE, Hist. Jamaica, 443, 1756, Jamaica.

*Esox brasiliensis*, LINNÆUS, Syst. Nat., Ed. x, 1758, 314, Jamaica; after BROWNE; the Timucu of Marcgrave wrongly included in the synonymy; BLOCH, Ichth., 391, 1801, corrected synonymy and description.

*Hemirhamphus marginatus*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., II, 1823, 135, Lesser Antilles; not of FORSKÅL.

*Hemirhamphus browni*,* CUVIER & VALENCIENNES, Hist. Nat. Poiss., XIX, 13, 1846, Guadaloupe; Martinique.

*Hemirhamphus pléii*, CUVIER & VALENCIENNES, *l. c.*, 19, Martinique; San Domingo; GÜNTHER, Cat., VI, 369, 1866; MEEK & GOSS, Proc. Ac. Nat. Sci. Phila., 1884, 225.

*Macrognathus brevirostris*, GRONOW, Cat., 148, 1854, Jamaica; after BROWNE.

*Hemirhamphus filamentosus*, POEY, Memorias, II, 297, 1861, Cuba.

*Hemirhamphus brasiliensis*, GÜNTHER, Cat., VI, 270, 1866; JORDAN & GILBERT, Synopsis, 224, 1883.

### 1073. HEMIRAMPHUS BALAO, Le Sueur.

(BALAÓ; PIPER.)

Head with lower jaw 2¾ in total length with caudal; depth 7½. D. 11 to 14; A. 11 or 12; vertebræ 39 + 16. Lower jaw 5⅕ times in length of body, ⅙ greater than rest of head. Eye 4 to 4½ in head (from tip of upper jaw). Scales moderate, caducous. Pectoral length equal to 1⅓ times depth of body; last ray of dorsal and anal slightly produced; anal very short. Back bluish; tip of lower jaw red; upper lobe of caudal dirty violet. Length 12 inches. Cuba. (Poey.) According to Poey this species has smaller scales, smaller eye, shorter beak, slenderer body and slightly longer pectorals than the preceding, and the upper lobe of the caudal differently colored. We have not seen it and do not know whether it is distinct. If a valid species, this must be the original *balaó*, which is said to have the caudal bluish, and the common species will stand as *H. brasiliensis*. (*Balaó*, a common Spanish name of species of this genus, from a word meaning to leap or dance.)

*Hemirhamphus balao*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., II, 1823, 136, Lesser Antilles.

*Hemirhamphus macrochirus*, POEY, Memorias, II, 299, 1861, Cuba.

## 329. EULEPTORHAMPHUS, Gill.

*Evleptorhamphus*, GILL, Proc. Ac. Nat. Sci. Phila., 1859, 131, (*brevoorti*).

This genus consists of pelagic species related to *Hemiramphus*, the body much more slender and greatly compressed, and the pectorals very long, approaching those of the flying-fishes. Ventrals small, inserted posteriorly. Air bladder not described, probably cellular. One species in our limits. (*εὐλεπτός*, very slender; *ῥάμφος*, beak.)

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* The types of *Hemirhamphus browni* (Museum at Paris; Martinique, Plée) have 52 scales in a lengthwise series; no 65, as stated by Valenciennes. The nominal species called *pléii* and *filamentosus* are identical with it.

### 1074. EULEPTORHAMPHUS VELOX, Poey.

Head $6\frac{3}{8}$; depth 10; mandible about 3. D. 22; A. 21; V. 6. Body extremely slender and elongated, much compressed, almost band-like. Back thin, subcarinate. Lower jaw very slender and long, much longer than the rest of the head. Teeth very feeble, the lower tricuspid. Eye large, about equal to snout, about 3 in head. Pectoral fins long and slender, half as long as mandible, more than $\frac{1}{4}$ the length of body; upper rays of pectorals broad and compressed; ventrals not longer than eye, inserted far back; caudal fin unequally forked, the lower lobe the longer. Olivaceous; sides silvery. Length 18 inches. West Indies, occasionally northward in the Gulf Stream to Massachusetts; rare.[*] Perhaps identical with the East Indian species, *Euleptorhamphus longirostris*, as supposed by Putnam and others, but no adequate[†] comparison of specimens of the two species has been made. (*velox*, swift.)

*?? Hemirhamphus longirostris*, CUVIER, Règne Anim., Ed. 2, Vol. 2, 286, 1829, Pondicherry.

*?? Hemirhamphus macrorhynchus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XIX, 55, pl. 556, 1846, open sea, 177° E., 7° S.

*? Euleptorhamphus brevoorti*, GILL, Proc. Ac. Nat. Sci. Phila., 1859, 131, no locality.

*Euleptorhamphus velox*, POEY, Synopsis, 383, 1867, Cuba; D. 19; A. 21.

*? Hemirhamphus longirostris* and *H. macrorhynchus*, GÜNTHER, Cat., VI, 276, 1866.

*Euleptorhamphus longirostris*,[‡] PUTNAM, Proc. Bost. Soc. Nat. Hist., 1870, 238; JORDAN & GILBERT, Synopsis, 377, 1883.

## Family XCVI. SCOMBRESOCIDÆ.

### (THE SAURIES.)

Body elongate, compressed, covered with small, thin, deciduous scales, the general aspect being that of a mackerel. Both jaws in the adult more or less prolonged, forming a slender beak, the upper jaw always the longer; teeth very feeble, pointed; maxillaries joined fast to premaxillaries; pectoral and ventrals small; dorsal and anal low, similar to each other, each with 4 to 6 detached finlets, as in the *Scombridæ*; gill rakers numerous, long and slender. Pharyngeal bones essentially as in *Exocœtus*; fourth upper pharyngeal on each side wanting or fused with the third; third pharyngeal greatly enlarged, separate from its fellow, covered with tricuspid teeth; second with simple teeth; first toothless; lower pharyngeals united, forming a triangular bone with concave surface, covered with tricuspid teeth; into the hollow of this bone the upper pharyngeals fit. Species four or five, here arranged in two genera; pelagic fishes, swimming close to the surface in large schools in temperate regions. They bear strong analogical resemblances to the mackerels in form, color, and habits, as well as in the dorsal and anal finlets. The significance of this resemblance is unknown. (*Scombresocidæ*, part, Günther, Cat., VI, 256–259, 1866.)

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[*] Lönnberg found a specimen on the beach at New Smyrna, Florida.

[†] Professor Putnam identifies the American species with the East Indian *E. longirostris*. Poey counts D. 19; A. 21; Valenciennes, D. 22; A. 20.

[‡] Poey thus describes *Euleptorhamphus velox*, comparing it with Cuvier's account of *E. longirostris*:

Height of body $10\frac{1}{3}$ in length of trunk from gill opening to base of caudal; head $5\frac{2}{3}$ in trunk; beak 4 in total length; eye $3\frac{1}{2}$ in head; pectorals $3\frac{1}{3}$ in length of trunk; base of dorsal as broad as pectoral; anal a little less, and farther back; dorsal rays as high as the trunk below them; lower caudal lobe much the longer. D. 19; A. 21. Silvery; back bluish; fins pale. (In *E. longirostris* the height as above goes 16 times; head 6; beak 4; eye 3 in head; pectorals $3\frac{2}{5}$, broader than dorsal; dorsal rays twice depth of body below it. D. 22; A. 20.)

*a.* Jaws produced in a very slender, pointed beak, longer in the adult than rest of head. SCOMBRESOX, 330.
*aa.* Jaws produced in a short beak, about half length of rest of head. COLOLABIS, 331.

## 330. SCOMBRESOX, Lacépède.

### (SAURIES.)

*Scombresox*, LACÉPÈDE, Hist. Nat. Poiss., v, 344, 1803, (*camperi*).
*Sayris*, RAFINESQUE, Caratteri Nuovi Generi, etc., 60, 1810, (*recurvirostra* = *camperi*).
*Grammiconotus*, COSTA, Annuario Mus. Zool. Napoli, 1862, 55, (*bicolor* = *serrata*).

Characters of the family as given above, but having both jaws more or less prolonged, forming a slender beak, the lower jaw the longer. Young with the jaws short, precisely as in the genus *Cololabis*, but lengthening with age, which is not the case in *Cololabis*. Air bladder large.* Atlantic. (*Scomber; Esox.*)

### 1075. SCOMBRESOX SAURUS (Walbaum).

### (SAURY; SKIPPER; BILLFISH.)

Head 3½; depth 9. D. 9–VI; A. 12–VI; scales 110. Head broad above, narrowed below, tapering anteriorly to the very slender, pointed beak; snout longer than the rest of the head, proportionately shorter in the young; lower jaw longer. Fins all small; caudal fin forked; ventrals midway between base of caudal and front of eye. Air bladder large. Olive brown above, sides and below silvery; a distinct silvery band, as broad as the eye, bounding the dark of the back. Length 18 inches. Temperate parts of the Atlantic Ocean; rather common, in schools, on both coasts, especially north of Cape Cod and France; found in the open seas.† (*Saurus*, σαῦρος, lizard.) (Eu.)

*Esox saurus*, WALBAUM, Artedi Pisc., III, 93, 1792, Cornwall; after the Saury Pike of PENNANT, Arctic Zoölogy.
*Scombresox camperi*, LACÉPÈDE, Hist. Nat. Poiss., v, 345, 1803, locality unknown; found in collection of Mr. Camper in Holland.
*Sayris recurvirostra*, RAFINESQUE, Caratteri, etc., 61, 1810; substitute for *camperi*.
*Sayris hians*, RAFINESQUE, *l. c.*, 61, Palermo.
*Sayris bimaculatus*, RAFINESQUE, *l. c.*, 62, Palermo.

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* A nominal species, *Scombresox serratus* (= *S. rondeleti* = *G. bicolor*) has been described from the Mediterranean, and is said to have no air bladder. Dr. Lütken (Spolia Atlantica, 567) is unable to verify this character and doubts its existence. An excellent account of the changes in development in *Scombresox* and other pelagic genera is given in this paper of Lütken.

† When pursued by the Tunny or Mackerels "multitudes mount to the surface, and crowd on each other as they press forward. When still more closely pursued they spring to the height of several feet, leap over each other in singular confusion, and again sink beneath. Still further urged, they mount again and rush along the surface, by repeated starts, for more than one hundred feet, without once dipping beneath, or scarcely seeming to touch the water. At last the pursuer springs after them, usually across their course, and again they all disappear together. Amidst such multitudes—for more than 20,000 have been judged to be out of the water together—some must fall a prey to the enemy; but, so many hunting in company, it must be long before the pursuers abandon. From inspection we could scarcely judge the fish to be capable of such flights, for the fins, though numerous, are small, and the pectoral far from large, though the angle of their articulation is well adapted to raise the fish, by the direction of their motions, to the surface."—*Goode*

*Scombresox scutellatum*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., II, 1821, 132, Newfoundland.

*Scombresox saurus*, FLEMING, Brit. Anim., 184; GÜNTHER, Cat., VI, 257, 1866.

*Scombresox storeri*, DE KAY, N. Y. Fauna: Fishes, 229, pl. 35, fig. 3, 1842, Banks of Newfoundland; Coast of Massachusetts; New York.

*Scombresox equirostrum*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., II, 1821, 132, locality unknown; found in a collection in Boston.

*Scombresox rondeleti*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVIII, 472, 1846, Mediterranean.

*Grammiconotus bicolor*, COSTA, Ann. Mus. Zoöl. Napoli, 55, 1862, Naples.

? *Scombresox forsteri*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XVIII, 481, 1846, New Zealand.

*Scombresox saurus*, JORDAN & GILBERT, Synopsis, 375, 1883; LÜTKEN, Spolia Atlantica, 567, 1880.

*Sayris serratus*, RAFINESQUE, Caratteri, 61, 1810; after RONDELET.

## 331. COLOLABIS, Gill.

*Cololabis*, GILL, new genus, (*brevirostris*).

This genus is close to *Scombresox*, differing chiefly in the very short beak, the upper jaw, even in the adult, not being at all produced, and the lower jaw having only a short flexible tip. This genus represents the immature state of *Scombresox*. (*κ̄ολος*, defective, curtailed; *λαβίς*, forceps.)

### 1076. COLOLABIS BREVIROSTRIS (Peters).

Head 5½; depth 9. D. 9–VI; A. 12–VI; scales 125. Body much elongate, compressed, widest above, the abdomen and lower edge of head trenchant. Upper jaw conical, not at all produced, but ending in a very acute tip; lower jaw slightly longer, its tip produced for a very slight distance, and flexible; triangular portion of premaxillaries as long as broad; snout a little more than half length of rest of head; interorbital space flat; maxillary reaching front of orbit. Teeth very minute, in a single row in each jaw. Eye large, in front of middle of head. Pectoral fin somewhat emarginate, ⅓ length of head; ventrals small, far back, slightly nearer tip of snout than tip of lower lobe of caudal; dorsal inserted slightly behind front of anal; both fins low, the finlets small; caudal widely forked, the lobes equal. Scales small, deciduous, those on top of head forming an elliptical patch. Dark green above, silvery below; sides with a lateral silvery stripe, bounded above by a dusky streak; upper fins mostly dusky; lower pale. Length 14 inches. Coast of California; very rare. Known from Tomales Bay, San Francisco, and San Diego; a most interesting fish, apparently closely related to a Japanese species, *Cololabis saira* (Brevoort). (*brevis*, short; *rostrum*, snout.)

*Scombresox brevirostris*, PETERS, Monatsberichte Akad. Wiss. Berl., July, 1866, 521, Tomales Bay; JORDAN & GILBERT, Synopsis, 375, 1883.

## Family XCVII. EXOCŒTIDÆ.

### (THE FLYING-FISHES.)

Body oblong or elongate, covered with cycloid scales, which are rather deciduous. Lateral line running very low, along the sides of the belly. Head more or less scaly, with vertical sides. Mouth moderate, terminal, the jaws not prolonged into a beak. Premaxillaries not protractile, hinged at base mesially; margin of the upper jaw chiefly formed by the premaxillaries; the short maxillaries entering the lateral margin; maxillary free from the premaxillary, its edge slipping under the front of the preorbital. Dentition various, the teeth small and weak. Dorsal fin without spines, inserted on the posterior part of the body, opposite the anal and more or less similar to it; ventrals abdominal, of several soft rays, inserted posteriorly; pectoral fin inserted high, used as an organ of flight; shoulder girdle and pectoral muscles very strong; caudal fin forked, the lower lobe the longer. No finlets. Vent close in front of anal. Nostrils large, double, near the eye. Lower pharyngeals enlarged and fully united, forming a large, transversely concave plate, covered with large, close-set, blunt, tricuspid teeth; third upper pharyngeal greatly enlarged, not united with its fellow, both covered with large, blunt, tricuspid teeth; fourth superior pharyngeal wanting in the adult (probably co-ossified with the third); (these characters verified on *Exocœtus californicus*); vertebræ without zygopophyses. Gill membranes not united, free from the isthmus. Pseudobranchiæ hidden, glandular. Gill rakers various. Gills 4, a slit behind the fourth. Air bladder very large, not cellular, so far as known, and extending far backward among the hæmopophyses of the caudal vertebræ. Vertebræ about 50. Intestinal canal simple, without cœca. Carnivorous or herbivorous. Genera 4; species about 65; abounding in all warm seas, mostly pelagic, swimming near the surface, and skipping or sailing through the air, sometimes for considerable distances. (*Scombresocidæ*, part, Günther, Cat., VI, 277-298, 1866.)

- *a.* Roof of mouth (vomer, palatines, pterygoids) and tongue provided with teeth; body not angular in outline (elliptical in cross section); pectoral fins moderate, not reaching beyond middle of dorsal fin; ventrals rather long, inserted behind middle of body; dorsal fin elevated; anal long, its base scarcely shorter than that of dorsal.
  - *b.* Snout long, slender, and pointed, much longer than eye; lower jaw acute, the tip much projecting (approaching *Hemiramphus*). FODIATOR, 332.
  - *bb.* Snout short, much shorter than eye; lower jaw scarcely produced at tip. PAREXOCŒTUS, 333.
- *a.* Roof of mouth and tongue with fewer teeth or none (the vomer and palatines toothed or not); body angular in outline (a cross section subquadrate); pectoral fins very long, their tips usually reaching nearly to base of caudal; lower jaw little prominent; snout short.
  - *c.* Ventral fins inserted anteriorly, much nearer tip of snout than base of caudal, not used as organs of flight, their tips not reaching nearly to front of dorsal; anal fin long, its base nearly equal to that of dorsal. HALOCYPSELUS, 334.
  - *cc.* Ventral fins inserted posteriorly, more or less nearer base of caudal than tip of snout; used as organs of flight, their tips reaching past middle of base of anal. EXOCŒTUS, 335.

## 332. FODIATOR, Jordan & Meek.

*Fodiator*, JORDAN & MEEK, Proc. U. S. Nat. Mus., 1885, 45, (*acutus*).

Body rather elongate; snout long, slender, and pointed, much longer than eye; lower jaw acute, the tip produced. Dentition as in *Parexocœtus*. Pectoral fins moderate; ventrals long, inserted posteriorly; dorsal high. One species known, widely distributed in tropical America. This genus marks the transition from *Hemiramphus* to *Exocœtus*. (*Fodiator*, one who stabs.)

### 1077. FODIATOR ACUTUS (Cuvier & Valenciennes).

(Sharp-nosed Flying-fish.)

Head 3½ in body; depth 5; eye 3¾ in head. D. 10; A. 11; scales 41. Snout long, about half longer than eye, 2½ in head; lower jaw much projecting, the half-beak at its symphysis about ⅓ the length of the snout. Origin of ventral fin midway between posterior margin of preopercle and last caudal vertebra. Pectoral fins half length of body, their tips reaching a little past front of dorsal; the first ray simple, about ¾ length of the fin, the second ray divided. Ventrals 1½ in length of head, their tips scarcely reaching front of anal. Dorsal and anal fins inserted opposite each other, the base of the anal slightly shorter than that of dorsal. Dorsal fin high, its longest ray 1⅓ in head. Color blue above, silvery below. Pectoral fins black on their posterior half, shading into lighter posteriorly; a large black blotch on the upper ⅔ of anterior rays of dorsal; ventrals and anal white; caudal dusky. Tropical America on both shores, rather common in the Gulf of California (San Luis Gonzales Bay), sometimes taken at Panama, and once recorded from Nice in France. (*acutus*, sharp.) (Eu.)

*Exocœtus acutus*, Cuvier & Valenciennes, Hist. Nat. Poiss., xix, 125, 1846, Surinam; Nice; Günther, Cat., vi, 281, 1866.
*Fodiator acutus*, Jordan & Meek, *l. c.*, 46.

## 333. PAREXOCŒTUS, Bleeker.

*Parexocœtus*, Bleeker, Nederl. Tydskr. Dierk., iii, 105, 1865, (*mento*).

Body moderately elongate, elliptical in cross section. Snout short; lower jaw not produced. Roof of mouth (vomer, palatines, and pterygoids) fully provided with teeth; pectoral fins moderate, not reaching beyond middle of dorsal; ventrals long, inserted behind middle of body; anal fin about as long as dorsal; dorsal high. Small flying-fishes of the tropical coasts, widely distributed. (*παρά*, near; *Exocœtus*.)

### 1078. PAREXOCŒTUS MESOGASTER (Bloch).

Head 4⅖ in length of body; depth 5. D. 12; A. 13; about 38 scales in the lateral line, 5 rows of scales between lateral line and dorsal fin. Body elongate, compressed (not angulated), rather deep; width of body at base of pectorals 2 in head; head narrow, compressed, almost trenchant below; interorbital area flattish, about as wide as eye, 3 in head. Snout short, rather pointed; its length 4¼ in head; teeth on tongue and palatines; gill rakers numerous, long and slender; pectoral fins of moderate length, their length 1⅔ to 2 in length of body, their tips reaching middle of base of dorsal fin; second ray of pectoral divided; dorsal fin very high, its longest rays about ⅙ longer than head; base of dorsal about 1⅐ in length of head; tips of anterior rays of dorsal reaching beyond tips of posterior rays when the fin is deflexed, and reaching almost to base of caudal fin; ventrals rather short, 4¾ in length of body, their tips reaching slightly past origin of anal fin; origin of ventrals midway between pupil and last caudal vertebra ; anal fin opposite dorsal ; lower lobe of caudal rather short, slightly longer than head. Color blue above, silvery below; pectorals (dusky in the young) becoming nearly white in the adult ; color of ventrals very similar to pectorals, the duskiness in the young formed of fine blackish dots ; upper half of anterior rays of dorsal fin black ; anal fin with few small black dots, more numerous in the young ; caudal dusky reddish. Length 7 inches. Tropical seas, common both in the East Indies and West Indies, and in the Hawaiian Islands. It ranges north in the Gulf Stream to Newport, and is the commonest flying-fish of the Carolina region. The young often has one or two fleshy barbels on the tip of the lower jaw, these being fragile and easily destroyed. (*μέσος*, middle; *γαστήρ*, belly, referring to the insertion of the ventrals.)

*Exocœtus mesogaster*, Bloch, Ichthyologia, pl. 399, 1795, Martinique; on a drawing by Plumier, in which the pectorals and ventrals are much too long; Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 588.

*Exocœtus orbignianus*, Cuvier & Valenciennes, Hist. Nat. Poiss., xix, 131, 1846, Montevideo; based on a drawing; Günther, Cat., vi, 285, 1866.

*Exocœtus hillianus*, Gosse, Nat. Sojourn Jamaica, ii, pl. 1, fig. 1, 1851, Jamaica; Lütken, Vid. Medd. Naturh. Foren., 397, 1876; Jordan & Gilbert, Synopsis, 903, 1883.

*Exocœtus gryllus*, Klunzinger, Fische des Rothen Meeres, 586, 1870, Red Sea; *fide* Lütken.

*Parexocœtus mesogaster*, Jordan & Meek, *l. c.*, 47.

## 334. HALOCYPSELUS, Weinland.

*Halocypselus*, Weinland, Proc. Bost. Soc. Nat. Hist., vi, 1859, 385, * (*mesogaster* = *evolans*).

This genus differs from *Exocœtus* mainly in the anterior position and small size of the ventral fins, which terminate in advance of the anal fin, and are not used as organs of flight. Species few; one of them the most widely diffused and abundant of all flying-fishes. (*ἅλς*, sea ; *κύψελος*, a swallow, or swift, living in holes in sand banks ; *κιψέλη*, a hollow vessel.)

### 1079. HALOCYPSELUS EVOLANS (Linnæus).

Head 4 in length; depth 5⅓. Snout rather blunt, 4½ in head; interorbital area flattish, 3 in head. Eye 3⅗ to 4¼ in head. D. 13; A. 13 ; scales about 42. Origin of ventral fins midway between tip of snout and last ray of anal ; length of ventrals half length of head ; pectorals 1⅓ in length of body, their tips reaching base of caudal ; first ray of pectoral simple, second divided ; anal fin long, scarcely shorter than dorsal, its first ray usually opposite first ray of dorsal ; dorsal low, its first ray less than half head ; lower lobe of caudal about ¼ longer than head. Gill rakers long and slender. Olivaceous above, dotted with dark. Pectoral fins dark above, with the lower margins white ; no white oblique crossbar; ventrals white ; caudal dusky ; dorsal and anal pale, without black markings ; a white streak along base of anal, wider and more conspicuous anteriorly. Young with 2 dark cross bands and sometimes with a small barbel at the chin. In all warm seas, north in summer to Newfoundland,

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* Although Dr. Weinland calls the type of this genus "*mesogaster*," it is evident from his description that the species examined by him was *Halocypselus evolans*.

England, and the Hawaiian Islands; rather common on our Atlantic coast, where it spawns in summer; not known from California or the west coast of Mexico. (*evolans*, flying away.) (Eu.)

*Exocœtus pinnis ventralibus brevissimus*, GRONOW, Zoöphylac., 1753, 358, Spain.

*Exocœtus evolans*, LINNÆUS, Systema Naturæ, Ed. XII, 521, 1766, based on GRONOW; GÜNTHER, Cat., VI, 282, 1866; LÜTKEN, Vid. Medd. Naturh. Foren., 1876, 395, 102.

*Exocœtus splendens*, ABEL, Narr. Voyage China, 4, 1818, China; (*fide* VALENCIENNES).

*Exocœtus georgianus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XIX, 139, 1846, 5° N., 92° W; GÜNTHER, Cat., VI, 279, 1866; LÜTKEN, Vid. Medd. Naturh. Foren, 394, 101, 1876; young examples, with barbel.

? *Exocœtus monocirrhus*, RICHARDSON, Ichth. China, 265, 1846, China; GÜNTHER, Cat., VI, 279, 1866; young examples, with barbel.

*Exocœtus chilensis*, ABBOTT, Proc. Ac. Nat. Sci. Phila., 1860, 472, Chile.

*Exocœtus obtusirostris*,[*] GÜNTHER, Cat., VI, 283, 1866, Cape Verde Islands; India; New Orleans; LÜTKEN, Vid. Medd. Naturh. Foren., 395, 1876.

*Halocypselus evolans*, JORDAN & GILBERT, Synopsis, 377, 1883; JORDAN & MEEK, *l. c.*, 49.

*Halocypselus obtusirostris*, JORDAN & GILBERT, Synopsis, 378, 1883.

## 335. EXOCŒTUS (Artedi) Linnæus.

### (FLYING-FISHES.)

*Exocœtus*, ARTEDI, Genera Piscium, 6, 1738.

*Exocœtus*, LINNÆUS, Systema Naturæ, Ed. X, 1758, 316, (*volitans*).

*Cypselurus*,[†] SWAINSON, Class'n Fishes, etc., II, 296, 1839, (*nuttalli*).

Body elongate, broad above, somewhat compressed. Head short, blunt, narrowed below. Mouth small. Jaws very short, about equal. Chin without barbel. Maxillaries not joined to the premaxillaries. Teeth very feeble or wanting. Eyes large. Gill rakers moderate. Scales large, deciduous. No finlets. Dorsal fin short, opposite anal. Caudal widely forked, the lower lobe the longer. Pectoral fins very long, reaching past the beginning of the anal, and serving as organs of flight, their great size enabling these fishes to sustain themselves in the air for some time.[‡]

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[*] This form, *Halocypselus obtusirostris*, is defined by Günther as having the snout shorter, $\frac{2}{3}$ diameter of eye, and the head more elevated, its depth $\frac{2}{3}$ its length. Lütken observes: "The dorsal fin inserted above or behind the first ray of the anal; the distance from the snout to the first ray of the ventrals less than the distance between the root of the ventral and last ray of the dorsal; 7 to 8 rows of scales above the lateral line; fins more distinctly marked. D. 13; A. 13. Lateral line 40," and further adds, "Although in most cases it is easy enough to decide 'whether a given specimen is *evolans* or *obtusirostris*,' yet there are some in which the determination seems to be almost arbitrary, therefore I am not fully convinced of their specific independence." The two nominal species occupy the same range, and we think the distinctions of *obtusirostris* to be individual variation.

[†] The name *Cypselurus* has been used by Swainson, Weinland, and others for those flying-fishes which are provided with 1 or 2 fleshy barbels or ribbons at the chin. These, we are fully convinced, are the young of other nominal species, which are destitute of barbels. It is probable that these appendages disappear at different ages in different individuals. In 2 species (*mesogaster*, usually described as destitute of barbels, and *furcatus*, described as with barbels) we have examined specimens both with and without these appendages. The name *Cypselurus* having been given to a species with the anal fin short, may be retained for the group or subgenus thus defined, which may perhaps be found worthy of generic rank.

[‡] Observations on the flight of these fishes and especially of *Exocœtus californicus* have been several times made under most favorable conditions by Dr. Charles H. Gilbert and the writers. The flying-fishes live in the open sea, swimming in large schools. They will "fly" a distance of from a few rods to more than an eighth of a mile, rarely rising more than 3 or 4 feet. Their movements in the water are extremely rapid; the sole source of motive power is the action of the strong tail while in the water. No force is acquired while the fish is in the air. On rising from the water, the movements of the tail are continued until the whole body is out of the water. While the tail is in motion, the pectorals seem to be in a state of rapid vibration, but this is apparent only, due to the resistance of the air to the motions of the animal. While the tail is

Ventral fins large, posteriorly inserted, also used as organs of flight. Air bladder very large. No pyloric cœca. Species numerous in all warm seas, living mostly in the open water and swimming in large schools. The species are largely cosmopolitan and any of the existing forms may be expected to be found within our limits.* (*ἐξώκοιτος*, sleeping outside, the ancient name of a certain fish, probably a *Blennius*, which was supposed to come out on the beach to sleep at night; it remains out in the *Fucus* when the tide goes down).

EXOCŒTUS:

*a.* Anal fin long, its base a little less than that of the dorsal, its first ray nearly opposite first ray of dorsal; rays of anal 11 to 12.

*b.* Second ray of pectoral simple (as well as the first); third ray divided; fourth and fifth rays longest.

*c.* Second ray of pectoral about as long as first ray; ventral fins inserted midway between posterior margin of eye and base of caudal (*i. e.*, end of last caudal vertebra). EXSILIENS, 1080.

*cc.* Second ray of pectoral about half longer than first; ventral fins inserted midway between middle of preopercle and last caudal vertebra. RONDELETI, 1081.

*bb.* Second ray of pectoral divided; first ray simple; third and fourth longest.

*d.* Origin of ventrals midway between posterior margin of orbit and last caudal vertebra; ventrals chiefly black. VINCIGUERRÆ, 1082.

*dd.* Origin of ventrals midway between posterior margin of preopercle and last caudal vertebra; ventrals pale, with a dusky shade in the axil.

*e.* Pectoral fins not uniform in color, dark brown, with an oblique, whitish band which begins in the axil and runs obliquely backward to middle of fin; edges of pectorals whitish. Pectoral fins $1\frac{2}{5}$ in length of body, their tips reaching beyond dorsal. Ventrals $3\frac{1}{2}$ in body, reaching about to ninth ray of anal. VOLITANS, 1083.

*ee.* Pectoral fins nearly uniform brownish, without oblique pale bar. Length of pectorals $1\frac{5}{11}$ in body, their tips scarcely reaching last ray of dorsal. Ventrals $3\frac{1}{2}$ in body, scarcely reaching last ray of anal. RUFIPINNIS, 1084.

CYPSELURUS (*κύψελος*, a swallow; *οὐρά*, tail):

*aa.* Anal fin short, its base $\frac{1}{2}$ to $\frac{2}{3}$ length of base of dorsal, its insertion behind first ray of dorsal, its rays 9 or 10.

*f.* Second ray of pectoral divided (first simple); third and fourth rays longest.

*g.* Pectoral fins without round dark spots.

*h.* Ventral fins inserted about midway between pupil and last caudal vertebra.

*i.* Dorsal and anal fins without black markings; ventrals pale.

*j.* Base of anal $1\frac{2}{3}$ in base of dorsal; pectoral $1\frac{4}{9}$ in length, reaching last ray of dorsal; ventrals $2\frac{3}{4}$ in body, reaching last ray of anal. HETERURUS, 1085.

*jj.* Base of anal 2 in base of dorsal; length of pectorals $1\frac{2}{5}$ in length of body, their tips reaching end of dorsal fin; length of ventrals $2\frac{8}{9}$ in body, their tips nearly reaching last ray of anal. LUTKENI, 1086.

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in the water, the ventrals are folded. When the action of the tail ceases, the pectorals and ventrals are spread and held at rest. They are not used as wings, but act rather as parachutes to hold the body in the air. When the fish begins to fall, the tail touches the water, when its motion again begins, and with it the apparent motion of the pectorals. It is thus enabled to resume its flight, which it finishes finally with a splash. While in the air it resembles a large dragon-fly. The motion is very swift, at first in a straight line, but later deflected into a curve. The motion has no relation to the direction of the wind. When a vessel is passing through a school of these fishes, they spring up before it, moving in all directions, as grasshoppers in a meadow.

*For comparative descriptions of the species of flying-fishes, see Lütken, Vidensk. Meddel. Nat. Foren., 1876, and Jordan & Meek, Proc. U. S. Nat. Mus., 1885. A very complete series of the American forms is in the Museum of the Academy of Natural Sciences, at Philadelphia.

*kk.* Dorsal and anal fins marked with black; dorsal with one or more dark blotches; anal with a black spot on tips of third to sixth rays; ventrals black, with pale edgings, and a white spot near the base. FURCATUS, 1087.

*jj.* Ventral fin inserted midway between posterior margin of preopercle and last caudal vertebra.

*m.* Pectorals each with the posterior half rather abruptly black; anal white. NIGRICANS, 1088.

*mm.* Pectorals unicolor or nearly so, not abruptly black posteriorly.

*n.* Pectorals uniformly black everywhere, the outer surface with silvery luster. XENOPTERUS, 1089.

*nn.* Pectorals nearly uniformly pale, or slightly dusky with pale edging and a pale cross shade.

*o.* Dorsal fin slightly dusky, but without distinct markings; other fins faintly shaded, but without distinct black markings; pectoral reaching base of last anal ray; ventrals almost as far. D. 13; A. 10. LINEATUS, 1090.

*oo.* Dorsal fin with a round, black blotch as large as eye on tips of middle rays; other fins all pale; pectoral reaching beyond tips of dorsal and anal. D. 12; A. 11. CYANOPTERUS, 1091.

*jjj.* Ventral fins inserted at a point midway between middle of opercle and last caudal vertebra (or between tip of snout and tip of upper lobe of caudal).

*p.* Dorsal fin with a large blackish blotch; pectorals nearly uniformly dusky; ventrals bluish white. Tip of pectorals reaching end of dorsal; tip of ventrals reaching middle of anal; insertion of ventral midway between tip of snout and that of upper lobe of caudal; dorsal fin of medium height, inserted much in advance of anal. Snout $\frac{4}{5}$ length of eye, which is $3\frac{1}{3}$ in head. Head $5\frac{1}{3}$ in total length (with caudal); depth $6\frac{1}{2}$. D. 13; A. 9 or 10; scales 50. BAHIENSIS, 1092.

*pp.* Dorsal fin pale, somewhat dusky above, without distinct black blotch; ventrals mesially blackish, the margins paler; dorsal rather pale, somewhat dusky above; pectorals mostly dusky, with the posterior edges paler; an obscure oblique band across lower part. Pectorals $1\frac{2}{7}$ in length of body, their tips reaching caudal fin. Ventrals $3\frac{3}{4}$ in body, their tips reaching middle of anal. Lower lobe of caudal about $\frac{1}{3}$ longer than head. Head $4\frac{4}{5}$ to 5 in length of body; depth 6. D. 12; A. 10. Snout 4 in head. Eye $3\frac{1}{3}$ in head. Base of anal $1\frac{2}{5}$ in base of caudal. Scales about 60. CALIFORNICUS, 1093.

*ii.* Pectoral fins covered with small, round, dark spots, the edges paler. CALLOPTERUS, 1094.

*hh.* Second ray of pectoral simple (like the first); third ray divided.

*q.* Snout more obtusely descending than in any other species, its length $4\frac{1}{2}$ in head. GIBBIFRONS, 1095.

## Subgenus EXOCŒTUS.

### 1080. EXOCŒTUS EXSILIENS, P. L. S. Müller.

Head 4 in length of body; depth $5\frac{1}{2}$. D. 11; A 11; scales 48. Body little compressed, angulated. Head broad; interorbital space slightly concave; snout rather blunt, short, $4\frac{2}{3}$ in length of head; interorbital area $2\frac{1}{4}$ in head; eye $2\frac{1}{3}$ in head; lower jaw slightly longer than upper. Pectorals long and broad, $1\frac{1}{3}$ in length of body, their tips reaching base of caudal; first 2 rays of pectoral simple and of equal length, their length $2\frac{1}{3}$ in length of fin, and connected to each other and to third ray by rather broad membranes; ventrals long, $2\frac{1}{3}$ in body, their tips reaching base of caudal fin; origin of ventrals midway between posterior margin of orbit and last caudal vertebra; last rays of dorsal and anal fins opposite each other; base of anal slightly shorter than that of dorsal; dorsal rather high, its longest ray 1⅖ in head; longest ray of anal 1¾ in head. Color brownish above, silvery below; pectorals and ventrals marbled with black; dorsal with a black spot on upper part of its anterior rays; lower caudal lobe with a black spot about ⅓ distance from its base; breast with 3 black cross bands; anal fin white. Open seas, rarely taken on our Atlantic Coast; only young specimens known; possibly the young of *Exocœtus rondeletii.* (*exsiliens*, leaping out, a name given by Müller in 1776, changed by Gmelin into "*exiliens*.")

*Exocœtus exsiliens*, PHILIP LUDWIG STATIUS MÜLLER, Nuremberg Ed. Linnæus Syst. Nat., 209, 1776, Carolina.

*Exocœtus exiliens*, GMELIN, Systema Naturæ, 1400, 1788, Carolina; GÜNTHER, Cat., VI, 291, 1866; JORDAN & MEEK, *l. c.*, 54.

*Exocœtus fasciatus*, LE SUEUR, Journ. Ac. Nat. Sci. Phila., 1821, 10, pl. 4, fig. 2, Atlantic.

*Exocœtus lamellifer*, KNER & STEINDACHNER, Neue Fische Mus. Godeff, 29, 1866, 12° S., 33° W.; LÜTKEN, Vid. Medd. Naturh. Foren., 405, 11, 1876.

### 1081. EXOCŒTUS RONDELETII, Cuvier & Valenciennes.

Head 4½ in length of body; depth 5½. D. 11; A. 11 or 12; scales 50, 25 before ventrals, and 28 before dorsal; snout short and blunt, 4 in head; eye 3⅕; interorbital space 2½. * Second ray of pectoral simple as well as the first and about half longer than first; anal fin opposite dorsal and about as long; ventral fins inserted midway between middle of preopercle and last caudal vertebra; ventrals 3½ in body, their tips reaching last rays of anal; length of pectorals 1⅜ in body, their tips reaching nearly to base of caudal fin; first ray of pectoral about half length of longest ray; dorsal moderate, its longest rays 2⅖ in head. Pectoral fins uniform dusky, with paler edgings; ventrals nearly black mesially, darker on their posterior half; no black markings on dorsal and anal fins. Length 11 inches. Tropical seas, north to Florida, France, and Acapulco, (Lütken); not uncommon in the West Indies and in Southern Europe. (Named for Guillaume Rondelet, one of the fathers of ichthyology.) (Eu.)

*Mugil alatus*, RONDELET, De Piscibus, IX, 207, 1554, France.

*Exocœtus rondeletii*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XIX, 115, 1846, Naples; Sicily; Canaries; GÜNTHER, Cat., VI, 293, 1866; VINCIGUERRA, † Risultati del Violante, 110, 1883; JORDAN & MEEK, *l. c.*, 55.

*Exocœtus brachycephalus*, GÜNTHER, Cat., VI, 297, 1866, China; LÜTKEN, *l. c.*, 110, 405, 1876.

*Exocœtus exiliens*, JORDAN & GILBERT, Synopsis, 380, 1883; not of LINNÆUS.

*Exocœtus volador*, JORDAN, Proc. U. S. Nat. Mus., 1884, 34, Pensacola. (Type, No. 34975. Coll. Stearns.)

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* This species is subject to some variations, or else, as Dr. Lütken suggests, we are uncertain as to the number of real species that group themselves around its type. In the typical specimen of *Exocœtus volador*, 9¼ inches long, the first ray of the pectoral is about half the fin, the second ray ⅔. In a smaller specimen, 7 inches long, from the Atlantic, the first ray is ⅓ the longest ray, or about half the second. Lütken finds the first ray scarcely ⅓ the longest, the second about half the longest, and not ⅔ the third ray. In other specimens he records notable variations in these regards. This species may possibly prove to be the adult of *E. exsiliens.*

† Dr. Vinciguerra has shown from the examination of type specimens, that this species is the original *Exocœtus rondeleti* instead of the next, as was supposed by Lütken and Bleeker.

### 1082. EXOCŒTUS VINCIGUERRÆ, Jordan & Meek.

Head $4\frac{1}{3}$; depth $6\frac{1}{3}$. D. 11; A. 12; scales about 48, 24 before ventrals, 28 before dorsal, 7 between dorsal and lateral line. Snout $4\frac{1}{3}$ in head; eye 3; interorbital area nearly flat, $2\frac{3}{4}$ in head. Anal fin opposite dorsal and about as long; second ray of pectoral forked, the first ray simple, third and fourth rays longest; origin of ventrals midway between posterior margin of orbit and last caudal vertebra; ventrals chiefly black; pectorals $1\frac{4}{7}$ in body, reaching last ray of dorsal; ventrals about 3 in length of body, their tips reaching slightly beyond last ray of anal; longest dorsal ray $2\frac{1}{2}$ in head; lower lobe of caudal $3\frac{1}{2}$ in body. Pectoral fins dusky, nearly uniform, or with a small white oblique bar, which extends halfway across the fin; the edges of the fin whitish; ventrals chiefly blackish; dorsal and anal without dark markings. Length about a foot. Open Atlantic, occasional on our coast and those of Southern Europe, the specimens examined by us from off Newfoundland, from St. Martins, and the Gulf of Mexico. (Named for Dr. Decio Vinciguerra, director of the Acquario Romano, an active and successful ichthyologist.) (Eu.)

*Exocœtus rondeleti*, Lütken, Vid. Medd. Foren., 404, 1876; not of Cuvier & Valenciennes; Jordan & Gilbert, Synopsis, 263, 1883.

*Exocœtus exiliens*, Vinciguerra, Risultati Ittiologici del Violante, 113, 1883; not of Gmelin.

*Exocœtus vinciguerræ*, Jordan & Meek, Proc. U. S. Nat. Mus., 1885, 56, open sea off Newfoundland, 46° N., 61° W. (Type, No. 21870. Coll. Albatross.)

### 1083. EXOCŒTUS VOLITANS, Linnæus.

Head $4\frac{1}{4}$; depth $6\frac{1}{5}$. D. 12; A. 11; scales 55, 25 before ventrals, 30 before dorsal; 6 rows between dorsal and lateral line. Snout rather obtuse, 4 in head; eye large, $2\frac{3}{4}$ in head; interorbital space slightly concave, $2\frac{7}{8}$ in head; width of body at base of pectorals $1\frac{3}{4}$ in head. Anal fin long, opposite dorsal; second ray of pectorals divided, the first simple, the third and fourth longest; insertion of ventrals midway between posterior edge of preopercle and base of caudal. Pectoral fins not uniform; in color dark brown, with an oblique, whitish band which begins in the axil and runs obliquely backward to middle of fin; edges of pectorals whitish. Pectoral fins $1\frac{2}{5}$ in length of body, their tips reaching beyond dorsal; ventrals $3\frac{1}{2}$ in body, reaching about to ninth ray of anal; longest dorsal ray $2\frac{1}{2}$ in head, anal ray 3; lower lobe of caudal $3\frac{1}{5}$ in body. Ventral fins white, with a slight dusky shade in the axil; no dark markings on dorsal or anal. Length 12 inches. Open seas; not rare on our Atlantic Coast, ranging north to the Grand Banks; also found in Southern Europe and the Hawaiian Islands. (*volitans*, flying.) (Eu.)

*Exocœtus*, Artedi, Genera Piscium, 18, 1738, locality not known.

*Exocœtus volitans*, Linnæus, Syst. Nat., Ed. x, 1758, 316; after Balk, who copied from Artedi; Jordan & Meek, *l. c.*, 57.

*Exocœtus rubescens*, Rafinesque, Amer. Monthly Mag., 1818, 205, Banks of Newfoundland.

*Exocœtus speculiger*, Cuvier & Valenciennes, Hist. Nat. Poiss., xix, 93, 1846, Friendly Islands; Straits of Sunda; Isle of France; Indian Ocean; Peros-Banhos; Pacific Coast of South America; Günther, Cat., vi, 287, 1866; Hutton, Fishes New Zealand, 55, 1872; Lütken, Vid. Med. Naturh. Foren., 403,109, 1876.

?*Exocœtus noveboracensis*, Cuvier & Valenciennes, Hist. Nat. Poiss., xix, 100, 1846, Newfoundland; not of Mitchill.

*Exocœtus roberti*, Müller & Troschel, Schomburgk's Hist. Barbadoes, 675, 1848, Barbadoes.

? *Exocœtus quadriremis*, Gronow, Cat., 145, 1854, Spain and India.

*Exocœtus affinis*, Günther, Cat., vi, 288, 1866, West Africa; Cuba?; Atlantic.

*Exocœtus melanurus*, Jordan & Gilbert, Synopsis, 380, 1883; not of Cuvier & Valenciennes.

*Exocœtus exiliens*, Jordan & Gilbert, Synopsis, 904, 1883; specimen from New England; not of Müller.

### 1084. EXOCŒTUS RUFIPINNIS, Cuvier & Valenciennes.

Head $4\frac{1}{6}$ in length to last caudal vertebra; depth $5\frac{3}{4}$. D. 11; A. 12; scales of lateral line 58. Body rather robust, not much compressed; head broad; interorbital area flat, its width 3 in head; eye rather small, its diameter $3\frac{1}{2}$ in head; snout rather blunt, its length equal to diameter of eye; mouth large; length of maxillary $4\frac{1}{4}$ in head. Pectoral fin broad and long, its length $1\frac{5}{11}$ in length of body; tips of pectorals scarcely reaching the last rays of dorsal fin; first ray of pectoral simple, $1\frac{2}{7}$ in length of fin, second ray divided, third and fourth rays longest; origin of ventrals midway between posterior edge of preopercle and last caudal vertebra, their tips scarcely reaching last ray of anal; length of ventrals $3\frac{1}{2}$ in length of body. First rays of dorsal and anal opposite each other (or nearly so); base of anal $1\frac{1}{3}$ in base of dorsal; base of dorsal $1\frac{1}{2}$ in head; lower lobe of caudal long, about $\frac{1}{4}$ longer than head; width of body at base of pectorals $1\frac{2}{3}$ in length of head. Least depth of caudal peduncle about $3\frac{2}{3}$ in length of head. Posterior margin of preopercle nearly vertical, forming almost a right angle at its lower posterior extremity. Gill rakers long, numerous, and slender. About 27 scales on lateral line before ventrals; about 30 scales between occiput and dorsal fin; 6 rows of scales between dorsal fin and lateral line. Color uniform brownish above, silvery below; pectorals colored like upper part of body, shading into darker toward their extremities; caudal uniform brownish, no dark markings on dorsal and anal fins; ventrals without distinct black markings. Length $9\frac{1}{2}$ inches. Tropical America, on both coasts (Payta, Panama, Tobasco, Barbadoes); probably not very common; the above description from the type specimen of *Exocœtus scylla*. (*rufus*, reddish; *pinna*, fin.)

*Exocœtus rufipinnis*, Cuvier & Valenciennes, Hist. Nat. Poiss., xix, 99, 1846, Payta, Peru; Günther, Cát., vi, 294, 1866; Jordan, Proc. Ac. Nat. Sci. Phila., 1884, 283 (redescription of original type); Jordan & Meek, *l. c.*, 58.

*Exocœtus dowi*, Gill, Proc. Ac. Nat. Sci. Phila., 1863, 167, near Panama. (Coll. Captain Dow.)

*Exocœtus scylla*, Cope, Trans. Am. Phil. Soc. Phila., 1871, 481, Tobasco, Mexico.

*Exocœtus roberti*, Lütken, Vid. Medd. Naturh. Foren., 1876, 12, 110; not of Müller & Troschel.

## Subgenus CYPSELURUS, Swainson.

### 1085. EXOCŒTUS HETERURUS, Rafinesque.

Head $4\frac{2}{3}$; depth $5\frac{1}{3}$; scales 58, 26 before ventrals, 33 before dorsal, 7 rows of scales between dorsal and lateral line. D. 14; A. 9. Anal fin short, its base $\frac{1}{2}$ to $\frac{2}{3}$ length of base of dorsal; its insertion behind first ray of dorsal; its rays 9 or 10; second ray of pectoral divided (first simple); third and fourth rays longest; ventral fins inserted about midway between pupil and last caudal vertebra; base of anal $1\frac{2}{3}$ in base of dorsal; pectoral $1\frac{4}{9}$ in length, reaching last ray of dorsal; ventrals $2\frac{3}{4}$ in body. reaching last ray of anal; snout $3\frac{3}{4}$ in head; eye $3\frac{1}{5}$; lower lobe of caudal about $\frac{1}{4}$ longer than head. Pectoral fins with an oblique white band across lower half of fin; dorsal and anal plain; ventrals white, their axil scarcely dusky. Length 15 inches. Atlantic Ocean, generally common southward on both coasts, straying northward to banks of Newfoundland and to England. The young are often provided with a long barbel at the chin. (ἕτερος, different; οὐρά, tail, but all species of flying-fishes have the tail unequal.)

*Exocœtus heterurus*, RAFINESQUE, Caratteri di Alcuni Nuovi Generi, etc., 58, 1810, Palermo; JORDAN & MEEK, *l. c.*, 59.

*Exocœtus comatus*, MITCHILL, Trans. Lit. and Phil. Soc. N. Y., 1815, 448, pl. 5, fig. 1, New York; LÜTKEN, Vid. Medd. Naturh. Foren., fig. 1, 106, 1876, 36° W., 11° N.; apparently a young form, with long mental barbel.

*Exocœtus noveboracensis*, MITCHILL, Amer. Monthly Mag., II, 1814, 233, New York; JORDAN & GILBERT, Synopsis, 904, 1883.

*Exocœtus appendiculatus*, WOOD, Journ. Ac. Nat. Sci. Phila., 1824, 283, pl. 17, fig. 24, (young), south coast United States.

*Exocœtus melanurus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XIX, 101, 1846, New York.

*Exocœtus volitans* GÜNTHER, Cat., VI, 293, 1866, not of LINNÆUS; LÜTKEN, Vid. Medd. Naturh. Foren., 10, 108, 1876; DAY, Fishes Great Britain, 155, pl. 228, 1883, (straggler to coast of England).

? *Cypselurus comatus*, JORDAN & GILBERT, Synopsis, 381, 1883.

### 1086. EXOCŒTUS LUTKENI, Jordan & Evermann, new species.

Head $4\frac{1}{4}$; depth $5\frac{1}{5}$. D. 14; A. 9; 50 scales in lateral line. Body rather robust. Head broad, rather pointed forward; snout not very blunt, $4\frac{1}{2}$ in length of head; eye large, $2\frac{3}{4}$ in head; interorbital area flattish, 3 in head. Pectoral fins broad, their tips reaching posterior end of base of anal fin; length of pectorals $1\frac{2}{5}$ in length of body. Length of ventrals $2\frac{8}{9}$ in length of body, their tips reaching nearly to posterior end of base of anal fin; origin of ventrals midway between pupil and base of caudal fin. First ray of pectoral simple, its length little more than $\frac{1}{2}$ length of fin; second ray divided; 23 scales before the ventrals; 28 scales before the dorsal fin; 7 rows of scales between lateral line and dorsal fin; longest dorsal ray 2 in head; lower lobe of caudal about $\frac{1}{4}$ longer than head. Color brownish above, silvery below; pectoral black on its posterior half; lighter on anterior, with a broad, white, oblique band which begins in the axil and extends about $\frac{2}{3}$ across the fin; ventrals white, dusky in axil; dorsal and anal fin plain; caudal dusky, with a black vertical bar across the base of its middle rays. This species is known from a single specimen, 9 inches long, in the museum of the Academy of Natural Sciences at Philadelphia, from Cape San Antonio, Cuba. It was formerly identified by Jordan & Meek with an Australian species, *Exocœtus robustus*, but it differs in numerous respects from the latter, although a related form. (Named for Christian Fredrik Lütken, one of the most learned and accurate of ichthyologists, whose paper on the flying-fishes is the basis of our present knowledge of the group.)

*Exocœtus robustus*, JORDAN & MEEK, *l. c.*, 61; probably not of GÜNTHER, Cat., VI, 289, 1866, Australia.

### 1087. EXOCŒTUS FURCATUS, Mitchill.

Head 4½; depth 5¼. D. 13; A. 9; lateral line with about 46 scales. Body rather slender, compressed. Head not very broad, much narrowed forward; the snout rather pointed; more compressed than in other species. Interorbital area flat, its width at anterior margin of orbit equal to diameter of eye; 3 in head; at posterior margin of eye this is half greater. Mouth small; maxillary not reaching orbit; length of maxillary 4¾ in head; length of mandible 2½ in head; length of snout 4⅕ in head; eye 3 in head. Pectoral fin long and broad; its length 1⅔ in length of body; tips of pectorals reaching to tenth ray of dorsal. First pectoral ray simple, slightly more than half length of fin; second ray divided; third and fourth rays longest. Origin of ventrals midway between posterior margin of eye and last caudal vertebra. Ventrals long, 2¼ in length of body; their tips reaching past anal and almost to caudal fin. Dorsal fin rather high, its longest ray 1½ in head; longest anal ray about 2 in head. Origin or dorsal in advance of that of the anal. Base of anal 1⅔ in base of dorsal; base of dorsal nearly equal to length of head. Lower lobe of caudal 3½ in body. About 23 scales on lateral line before ventrals, and about 29 in front of dorsal fin. Eight rows of scales between lateral line and dorsal fin. Color brownish above, silvery below; pectoral fins black on lower posterior half; a broad white band running from axil obliquely back to the posterior of upper rays; some white on tips of pectoral rays; anterior upper portion of the fin somewhat marbled; ventral fins black, except on 2 outer rays, on inner ray, and a small spot on next 2 inner rays, about ¼ distance from origin of fin; axil of ventrals pale. Dorsal fin, when depressed, showing 3 black spots; caudal fin with 3 dark tranverse bands across fin; a black spot on tips of third, fourth, fifth, and sixth rays of anal fin. Length 6 inches. Warm seas, north to Cape Cod and to the Mediterranean, generally common. Young specimens with barbels of different forms and sizes are frequently taken. The specimens above described from Newport, Rhode Island. (*furcatus*, forked.)

*Exocœtus furcatus*, Mitchill, Trans. Lit. and Phil. Soc. N. Y., I, 1815, 149, young, with barbel; New York; Günther, Cat., VI, 286, 1866; Lütken, Vid. Medd. Naturh. Foren., 400, 1876; Jordan & Meek, *l. c.*, 61.

*Exocœtus nuttalli*, Le Sueur, Journ. Ac. Nat. Sci. Phila., 1821, 10, pl. IV, fig. 1, Gulf of Mexico; Günther, Cat., VI, 286, 1866.

*Exocœtus* (*Cypselurus*) *procne*, De Filippie Verany, Mem. Acad. Sci. Torino, series 2, XVIII, 1857, 10, Nice.

*Exocœtus maculipinnis*, Vinciguerra, Risultati Ittiologici del Violante, pl. I, fig. 6, 113, 1883, Tunis.

*Cypselurus furcatus*, Jordan & Gilbert, Synopsis, 380, 1883.

### 1088. EXOCŒTUS NIGRICANS, Bennett.

Head 4¼ in body; depth 5⅔; snout 4 in head; eye 3¼. D. 14; A. 9 or 10; scales about 52, 27 before the ventral fins, 26 in front of dorsal. Anal fin short, its base ½ to ⅔ length of base of dorsal, its insertion behind first ray of dorsal; its rays 9 or 10; second ray of pectoral divided (first simple); third and fourth rays longest; ventral fins inserted midway between posterior margin of preopercle and last caudal vertebra; pectorals not uniformly colored; posterior half of pectorals, ventrals, and dorsal rather abruptly black; anal white. Length of pectoral fin 1⅓ in body, its tip reaching nearly to base of caudal; first ray of pectoral 1⅘ in length of longest; ventrals 2⅘ in length of body, their tips reaching tip of last ray of anal; dorsal rather high, its longest rays 1⅓ in head; longest anal ray 3½ in head, lower lobe of caudal about ¼ longer than head. Interorbital space broad, slightly concave, its width 2⅔ head; depth of head 1⅔ in its length. Length 10 inches. Tropical seas, north to Cuba, Central America, and France; not very common; recognizable at once by its high dorsal, black on the anterior half. The specimen here described was from the Open Atlantic off Brazil. (*nigricans*, blackish.) (Eu.)

*Exocœtus nigricans*, Bennett, Whaling Voyage, II, 287, 1840, "taken in both the Atlantic and Pacific Oceans, in lat. 5° N."; Günther, Cat., VI, 290, 1866; Jordan & Meek, *l. c.*, 63.

*Exocœtus bicolor*, Cuvier & Valenciennes, Hist. Nat. Poiss., XIX, 111, 1846, Atlantic.

*Exocœtus spilopus*, Cuvier & Valenciennes, Hist. Nat. Poiss., XIX, 118, 1846, La Rochelle; St. Helena; West Indies; India; Arabia; De Witt Land; Guichenot, Hist. Cuba, Ramon de la Sagra, Poiss., fig. 2, 1853, 152, pl. 4; Lütken, Vid. Med. Naturh. Foren., 107, 1876.

### 1089. EXOCŒTUS XENOPTERUS, Gilbert.

Head 4⅕; depth 6. D. 13; A. 10; scales about 45. Snout short, 3¾ in head; mandible scarcely protruding, wide at tip, with a narrow band of small teeth. Teeth along edge of premaxillaries in a single series. Vomer with a narrow patch, palatines with a wide patch of well-developed teeth, similar to those in jaws; no teeth on tongue. Preorbital about as wide as pupil; distance from tip of snout to end of maxillary equals length of snout. Eye large, 3¼ in head. Interorbital width 3 in head. Distance from front of dorsal to base of middle of caudal rays equals half its distance from posterior margin of pupil. Length of dorsal base equals ⅔ length of head, the highest ray 2⅔ in head. Origin of anal under middle of dorsal, its base equaling snout and half eye, the last ray nearly under last dorsal ray. Lower lobe of caudal 3½ in length; the upper slightly less than head. Origin of ventrals halfway between base of caudal and preopercular margin, the tip reaching base of third anal ray, a trifle shorter than head. First pectoral ray ⅗ the longest; second ray deeply forked, the third and fourth apparently the longest (the tips slightly mutilated). The fin extends beyond dorsal, and falls short of the caudal by a trifle. Black above, becoming abruptly silvery on middle of sides; pectorals jet black within, overlaid by some silvery luster without; median ventral rays black, the inner and outer white; dorsal dusky, without distinctive marks; anal white; caudal black on basal portion of both lobes, the remaining third white. A single specimen, 9½ inches long, taken from a booby-bird (*Sula*) on Clarion Island, one of the Revillagigedos. (ξένος, strange; πτέρον, fin.)

*Exocœtus xenopterus*, Gilbert, Proc. U. S. Nat. Mus., 1890, 58, Clarion Island. (Type, No. 44388, Coll. Albatross.)

### 1090. EXOCŒTUS LINEATUS, Cuvier & Valenciennes.

Head 4⅘; depth 6½. Anal short, its rays I, 10; dorsal 13. Second ray of pectoral divided, the first ray ¾ length of longest. Head rather pointed, the interorbital area flat; snout 4 in head; eye 3⅓. Pectoral extending to base of last anal ray; ventrals reaching nearly as far, their insertion midway between base of caudal and edge of preopercle. Dark lines on sides of back conspicuous only where scales have been rubbed off, not forming an important feature of coloration; fins mostly dusky; ventrals with faint dusky shades; anal with an obscure dark shade; dorsal and caudal somewhat dusky, but unmarked. Close to *Exocœtus heterurus*, distinguished by the more backward position of the ventrals. Tropical Atlantic, recorded from Corea, the Canaries, Madeira, and Bermuda. The above description from the original type, 16 inches long, from Corea. (*lineatus*, streaked.)

*Exocœtus lineatus*, Cuvier & Valenciennes, Hist. Nat. Poiss., XIX, 92, 1836, Corea; Canaries; Günther, Cat., VI, 287, 1866; Goode, Bull. U. S. Nat. Mus., V, 76, 1876; Jordan, Proc. U. S. Nat. Mus., 1886, 528.

### 1091. EXOCŒTUS CYANOPTERUS, Cuvier & Valenciennes.

D. 12; A. 11. Second ray of pectoral divided, the first ⅗ length of fin. Snout pointed; interorbital area transversely concave. Snout 3½ in head; eye 3⅓; tail strong; dorsal moderately high, its base ⅓ longer than that of the rather short anal. Insertion of anal considerably behind that of dorsal. Pectoral extending beyond tips of last ray of dorsal and anal. Ventrals not quite to the base of the last ray. Insertion of ventrals midway between base of caudal and edge of preopercle. Fins all pale, except a round black blotch, about as large as eye, on tips of middle dorsal ray; ventrals white. Coasts of Brazil and Caribbean Sea; not common; close to *Exocœtus bahiensis*, and perhaps not even distinct; also recorded from James Island of the Galapagos. The anal rays are less numerous in *E. bahiensis* than in the original type of *E. cyanopterus*, from which the above account is taken. (*κυάνεος*, blue; *πτερόν*, fin.)

*Exocœtus cyanopterus*, Cuvier & Valenciennes, Hist. Nat. Poiss., XIX, 98, 1846, Bahia; Rio de Janeiro; Günther, Cat., VI, 294, 1866; Jordan, Proc. U. S. Nat. Mus., 1886, 528; Jordan & Bollman, Proc. U. S. Nat. Mus., 1889, 180.

*Exocœtus albidactylus*, Gill, Proc. Ac. Nat. Sci. Phila., 1863, 167, Caribbean Sea; erroneously ascribed to Panama.

### 1092. EXOCŒTUS BAHIENSIS, Ranzani.

Head 5⅓; depth 6½ with caudal. D. 13; A. 9–10; scales 50. Length of snout ⅘ of that of eye, which is 3⅓ in head; pectorals reaching end of dorsal, ventrals to middle of anal; insertion of ventrals midway between end of snout and extremity of upper caudal lobes; dorsal of moderate height, its origin far in advance of that of anal. Coloration of the pectorals uniform; dorsal with a large dark blotch. (Günther.) Tropical seas, north to Cuba, where it seems to be the commonest of the flying-fishes; not examined by us. (Name from Bahia.)

*Exocœtus bahiensis*, Ranzani, Nov. Comm. Ac. Sci. Inst. Bonon., v, 1842, 362, pl. 38, Bahia; Günther, Cat., vi, 293, 1866; Poey, Synopsis, 384, 385, 1868; Lütken, Vid. Medd. Naturh. Foren., 402, 108, 1876.

*Exocœtus vermiculatus*, Poey, Memorias, ii, 300, 1861, Cuba.

*Exocœtus spilonotopterus*, Bleeker, "Nederl. Tydschr. Dierk., iii, 113, 1863," Sumatra.

? *Exocœtus parræ*, Poey, Synopsis, 385, 1868, Cuba; description insufficient; taken from an old drawing.

### 1093. EXOCŒTUS CALIFORNICUS, Cooper.

(Great Flying-fish; Volador.)

Head 5; depth 6. D. 12; A. 10; scales 58; vertebræ $33 + 16 = 49$. Body stoutish. Lower jaw rather the longer; both jaws with minute teeth. Eye large, rather longer than snout, 3 in head, nearly equal to the diameter of the slightly concave interorbital space. Pectoral fin reaching past the dorsal and falling just short of the caudal; second ray of pectoral divided, the third longest; ventrals about reaching middle of anal, their length 3⅘ in body, their insertion midway between middle of opercle and base of caudal. Anterior rays of dorsal half the length of the head; 43 rows of scales between occiput and dorsal, 7 between the dorsal and the lateral line. Steel blue above and on both sides, belly abruptly silvery; pectorals blackish, with the posterior edge paler; an obscure oblique pale band across lower part; caudal plain dusky; ventrals pale, partly dusky; dorsal rather pale, with a dusky blotch above. Length 18 inches. Southern California, Point Concepcion to Cape San Lucas, very abundant in great schools in summer about the Santa Barbara Islands. It is not known whither it retires in winter, as it has not been seen outside of California, it being the only species known in the Eastern Pacific north of Cape San Lucas. It is probably the largest of the flying-fishes and has the greatest power of movement in the air. An excellent food-fish, sometimes taken by the thousand off Santa Barbara.

*Exocœtus californicus*, Cooper, Proc. Cal. Ac. Sci., iii, 1864, 93, fig. 20, Santa Catalina Island; Günther, Cat., vi, 295, 1866; Jordan & Gilbert, Synopsis, 379, 1883; Jordan & Meek, *l. c.*, 15.

### 1094. EXOCŒTUS CALLOPTERUS, Günther.

Head nearly 4 in length (to base of caudal); depth 5. D. 11 or 12; A. 8 to 10. Anal fin short, its base ½ to ⅔ length of base of dorsal; its insertion behind first ray of dorsal; its rays 9 or 10; second ray of pectoral divided (first simple); third and fourth rays longest; pectoral fins covered with small, round, dark spots, the edges paler; ventral fins pale, the middle rays grayish, obscurely spotted; other fins pale. Pectoral fins reaching to end of dorsal; ventral fins inserted midway between preopercle and base of caudal, their tips reaching nearly to base of anal; dorsal fin rather high, its anterior rays about half length of head. Scales 46, 34 before the dorsal fin, and 9 between lateral line and dorsal fin. Snout obtuse and depressed, ⅗ diameter of eye, which is 3 in head, and less than width of interorbital space, which is slightly concave. Length 10 inches. A beautiful little flying-fish, common at Panama, but not yet seen elsewhere. (*κάλλος*, beauty; *πτερόν*, fin.)

*Exocœtus callopterus*, Günther, Cat., vi, 292, 1866, Panama, (Coll. Capt. Dow); Günther, Fishes Central Amer., 479, pl. 83, 1869; Lütken, Vid. Medd. Naturh. Foren., 401, 107, 1876; Jordan & Gilbert, Bull. U. S. Fish Comm., ii, 1882, 109; Jordan & Meek, *l. c.*, 65.

### 1095. EXOCŒTUS GIBBIFRONS, Cuvier & Valenciennes.

Head 4⅗; depth 6. D. 12; A. 8. Body robust, little compressed. Head rather short, interorbital area slightly concave, about ¼ wider than eye; profile of snout convex, descending more abruptly than in any other of our species, making a decided curve downward. Snout rather blunt, 4 in head; eye 3 in head; maxillary 4½ in head; pectoral fins rather broad and long, their length 1½ in length of body; tips of pectorals reaching to tips of last rays of dorsal. First ray of pectoral simple, its length 2⅕ in length of fin; second ray simple, about ½ longer than first ray; third ray divided; fourth ray longest. Origin of ventrals midway between posterior margin of eye and last caudal vertebra; length of ventrals 2.9 in length of body, their tips reaching to last ray of anal. Origin of dorsal fin far in advance of the anal. Base of anal 1⅗ in base of dorsal. Longest dorsal ray 2⅕ in head, longest anal ray about 3 in head. Lower lobe of caudal about 3½ in body; least depth of caudal peduncle 3⅕ in head. About 25 scales in lateral line before ventrals, and about 30 scales before dorsal; 7 scales between lateral line and dorsal fin. Color brown above, silvery below; on each scale on the upper part of the body is a darker brown spot near its posterior extremity; this gives the appearance of a dark-brown streak along each row of scales; pectorals uniformly colored, same color as upper part of body; ventrals dusky, nearly black mesially, the posterior part of the fin still darker; no dark markings on dorsal or anal fins; caudal dusky, plain. Length 8 inches. Atlantic Ocean; two specimens known, both examined by us; the specimen above described taken by Samuel Powell at Newport, Rhode Island, the other the original type in the Museum at Paris. (*gibbus*, gibbous; *frons*, forehead.)

*Exocœtus gibbifrons*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XIX, 118, 1846, Atlantic; JORDAN & MEEK, *l. c.*, 65; JORDAN, Proc. U. S. Nat. Mus., 1886, 528.

## Order Z. HEMIBRANCHII.

### (THE HEMIBRANCHS.)

Interclavicles developed. Gills pectinate. Post-temporal simple, not furcate; supraclavicle quite small. Superior pharyngeal bones reduced in number, the bones of the gill arches also reduced except in *Gasterosteidæ*; inferior pharyngeals present, not united. Ventral fins abdominal or subabdominal, joined to the interclavicle, or else detached from it through partial atrophy of the shoulder girdle. Mouth bounded above by premaxillaries only; shoulder girdle simple in structure. Basis of cranium simple and without tube; four anterior vertebræ more or less elongate; snout usually more or less produced, the small mouth at its end. A small group, well distinguished from the *Percesoces* and other *Teleocephali*, from ancestors of which it is probably descended, differing in the presence of the interclavicles and in the reduction of the shoulder girdle and other structures. Its relations to the *Lophobranchii* are close, the characters of the *Lophobranchii* being largely extremes of the same modifications. (ἡμι, half; βράγχος, gill.)

In the following analysis of families we adopt the arrangement of families as given in Dr. Gill's valuable discussion of "the mutual relations of the *Hemibranchiate* fishes" in Proc. Ac. Nat. Sci. Phila., 1884, 154. The osteological characters are largely taken from unpublished notes of Mr. Cloudsley Rutter. We begin the series with the most generalized family.

*a.* Dermal armature absent, or developed only as plates on sides or back; vertebræ numerous (30 to 36); pubic bones connected with scapular arch; spinous dorsal represented by isolated spines.

*b.* Vertebræ anteriorly little enlarged; ventrals subthoracic, each with a sharp spine.

*c.* Branchiostegal rays three; ventrals with one soft ray each; snout conic or but slightly tubiform. GASTEROSTEIDÆ, XCVIII.

*cc.* Branchiostegal rays four; ventrals with four soft rays each; snout tubiform. AULORHYNCHIDÆ, XCIX.

*bb.* Vertebræ anteriorly (first four) elongate; ventrals subabdominal or near middle of body, without spines, but with 6 (or 5) soft rays.

*d.* Dorsal spines developed, weak; body compressed, moderately long, with ctenoid scales; no caudal filament. AULOSTOMIDÆ, C.

*dd.* Dorsal spines undeveloped; body depressed or subcylindrical, very long, without scales; caudal with the two middle rays produced into a long filament. FISTULARIIDÆ, CI.

*aa.* Dermal armature superficial, developed anteriorly and especially about the back; four anterior vertebræ much elongate; tail with its axis continuous with that of the abdomen; branchihyals and pharyngeals mostly present (fourth superior branchihyal and first and fourth superior pharyngeals wanting); pubic bones not connected with the scapular arch; a spinous dorsal fin developed. MACRORHAMPHOSIDÆ, CII.

## Family XCVIII. GASTEROSTEIDÆ.

### (THE STICKLEBACKS.)

Body more or less fusiform, somewhat compressed, tapering behind to a slender caudal peduncle. Head moderate, the anterior part not greatly produced, but all the bones of the suspensory apparatus somewhat lengthened. Mouth moderate, with the cleft oblique, the lower jaw prominent; maxillary bent at right angles and overlapping the premaxillary at corner of mouth. Teeth sharp, even, in a narrow band in each jaw; no teeth on vomer or palatines; premaxillaries protractile. Preorbital rather broad; suborbital plate large, often covering the anterior part of the cheeks, forming a connection with the preopercle. Branchiostegals 3. Gill * membranes broadly joined, free from the isthmus, or

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* According to Mr. Rutter the gill formula is:

| | Basi-branchial. | Hypo-branchial. | Cerato-branchial. | Epi-branchial. | Pharyngo-branchial. |
|---|---|---|---|---|---|
| 1 | Present. | Present. | Present. | Present. | ------------ |
| 2 | Present. | Present. | Present. | Present. | Present. |
| 3 | ------------ | Present. | Present. | Present. | Present. |
| 4 | ------------ | ------------ | Present. | Present. | ------------ |

The third and fourth epibranchials are present, but apparently grown together. The same is probably true of the third and fourth pharyngobranchials.

The species examined was *Gasterosteus microcephalus*, GIRARD.

not; gill rakers moderate or rather long. Opercles unarmed. Skin naked or with vertically oblong bony plates; no true scales. Dorsal fin preceded by two or more free spines; anal similar to soft dorsal, with a single spine; ventral fins subabdominal, consisting of a stout spine and one or two rudimentary rays. Middle or sides of belly shielded by the pubic bones. Pectorals rather short, unusually far behind the gill openings, preceded by a quadrate naked area, which is covered with shining skin. Caudal fin narrow, usually lunate. Air bladder simple; a few pyloric cœca. Vertebræ 30 to 35; anterior vertebræ little enlarged. Genera 5; species about 12. Small fishes inhabiting the fresh waters and arms of the sea in Northern Europe and America; noted for their pugnacity. They are exceedingly destructive to the spawn and fry of larger fishes. "It is scarcely to be conceived what damage these little fishes do, and how greatly detrimental they are to the increase of all the fishes among which they live, for it is with the utmost industry, sagacity, and greediness that they seek out and destroy all the young fry that come their way." (Günther.) Most of the sticklebacks build elaborate nests which the male fish defends with much spirit. The species are extremely variable, being apparently readily affected by changes in surroundings. (*Gasterosteidæ*, Günther, Cat., I, 1-7, 1859.)

GASTEROSTEINÆ:*

*a.* Pubic bones fully joined, forming a triangular or lanceolate plate on median line of belly behind and between the ventral fins.
  *b.* Snout moderately produced, not tubiform; caudal peduncle moderate; ventral not far behind pectoral, its rays I, 1.
    *c.* Gill openings confluent, the gill membranes forming a broad free margin across the isthmus.
      *d.* Dorsal spines 4 or 5, nondivergent, and nearly equally reclinable; skin naked; tail not keeled. EUCALIA, 336.
      *dd.* Dorsal spines 8 to 11, divergent; skin naked or nearly so; tail keeled. PYGOSTEUS, 337.
    *cc.* Gill openings restricted, the membranes mesially united to the isthmus; dorsal with two free spines; skin mailed, partly mailed, or naked. GASTEROSTEUS, 338.

APELTINÆ:

*aa.* Pubic bones widely separated posteriorly, forming a bony ridge on each side of abdomen, between which are the ventral fins; snout short.
  *e.* Dorsal with four divergent spines; sides not mailed. APELTES, 339.

## 336. EUCALIA, Jordan.

*Eucalia*, JORDAN, Man. Vert., Ed. I, 248, 1876, (*inconstans*).

Fresh-water sticklebacks, feebly armed, the skin not mailed, the dorsal spines few and nondivergent, the gill membranes forming a free fold across the isthmus; pubic bones fully united. One species known. (εὖ, well; *καλιά*, nest, the species building nests, like other sticklebacks.)

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* The subfamily *Spinachiinæ*, with the snout much produced, subtubiform, the dorsal spines about 15 and the pubic bones joined only at base, consists of the European species, *Spinachia spinachia* (Linnæus). It is not rare in Northern Europe and has been once (probably by error in labeling) ascribed to Newfoundland. See Sauvage, Révision des Épinoches, 1874, 36.

### 1096. EUCALIA INCONSTANS (Kirtland).

(Brook Stickleback.)

Head 3½; depth 4. D. IV–I, 10; A. I, 10; vertebræ 14 + 18 = 32. Body moderately elongate, little compressed, the caudal peduncle comparatively stout, not keeled. Skin smooth, entirely destitute of dermal plates, the skeleton plates covered by it. Innominate bone small, lanceolate, covered by the skin. Space in front of pectorals small; thoracic processes very slender and widely separated, covered by skin. Gill membranes somewhat free posteriorly; gill rakers short. Dorsal spines 4 or 5, low, subequal, in a right line, a cartilaginous ridge running along the base of the fin; anal spine similar to dorsal spines; ventral spines short and sharp, serrated. Males in spring jet black, tinged with red anteriorly; females and young olivaceous, mottled, and dotted with black. Length 2½ inches. New York to Kansas* and northward to the Saskatchewan (Swift Current, etc.—Eigenmann); in fresh waters only, and especially in small brooks; abundant in the Great Lake region and south to central Ohio and Illinois, the southernmost record being from Decatur County, Indiana. (W. P. Shannon.) Very variable. (*inconstans*, variable.)

*Gasterosteus inconstans*, Kirtland, Bost. Journ. Nat. Hist., iii, 1841, 273, brooks of Trumbull County, Ohio.

*Gasterosteus micropus*, Cope, Proc. Ac. Nat. Sci. Phila., 1865, 81, Fort Riley, Kansas. (Coll. Dr. Hammond.)

*Gasterosteus globiceps*, Sauvage, Révision des Épinoches, 35, 1874, North America.

*Eucalia inconstans*, Jordan, Proc. Ac. Nat. Sci. Phila., 1877, 65; Eigenmann, Proc. Ac. Nat. Sci. Phila., 1886, 238.

*Gasterosteus inconstans*, Jordan & Gilbert, Synopsis, 394, 1883.

Represented in central and western New York by

### 1096a. EUCALIA INCONSTANS CAYUGA Jordan.

Ventral spines as long as pubic bones (usually ⅔ in *inconstans*); pectoral plate small, U-shaped (V-shaped in *inconstans*). Fin rays the same, the size generally smaller. Known from about Ithaca and Syracuse, N. Y., in small brooks and in the lakes.

*Eucalia inconstans cayuga*, Jordan, Man. Vert., Ed. i, 249, 1876, Cayuga Lake, Ithaca, N. Y. (Coll. Dr. B. G. Wilder.)

Represented in Lake Superior by

### 1096b. EUCALIA INCONSTANS PYGMÆA (Agassiz).

D. III or IV, I, 6; A. I, 6. Said to have the body shorter and deeper, the rays different. Lake Superior. (Agassiz.) If this difference in fin rays really exists, this may be a distinct species. (*pygmæus*, dwarf.)

*Gasterosteus pygmæus*, Agassiz, Lake Superior, 314, 1850, Lake Superior.

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* Recorded from Sukkertoppen, Greenland, by Cope, Proc. Ac. Nat. Sci. Phila., 1865, 81. This record needs verification. According to Cope, the Kansas form, *micropus*, is shorter and deeper than *inconstans*, with smaller postpectoral plate and weaker ventral spines.

## 337. PYGOSTEUS, Brevoort.

*Pygosteus* (Brevoort) Gill, Cat. Fishes East Coast N. A., 39, 1861; name only.
*Pygosteus*, Gill, Canadian Naturalist, ii, 8, 1865, (*occidentalis*).
*Gasterostea*, Sauvage, Révision des Épinoches, 29, 1874, (*pungitius*).

This genus is characterized by the presence of 9 to 11 divergent spines and by the weakness of its innominate bones. As in *Eucalia*, the gill membranes form a broad fold across the isthmus. Vertebræ 14 + 18 = 32. Species 2, in northern regions, the following cosmopolitan; a second, *Pygosteus sinensis*, Guichenot, from China. (*πυγή*, pubic region; *ὀστέον*, bone.)

### 1097. PYGOSTEUS PUNGITIUS (Linnæus).

(Nine-spined Stickleback.)

Head 4; depth 5 to 6. D. VIII or IX–I, 9; A. I, 8. Body very slender, somewhat compressed, tapering into the very long and slender caudal peduncle, which is much depressed and strongly keeled, broader than deep. No dermal bony plates along sides; small plates along bases of dorsal and anal, and on caudal keel; skeletal plates not at all covered by skin. Postpectoral plate well developed, striated. Head shortish, the snout rather blunt. Eye large, longer than snout. Thoracic processes well developed, widely divergent, forming a U-shaped figure. Bones of skull granulate, its surface bones all weak. Dorsal spines moderate, the anterior diverging to the right or left at various angles, the posterior more nearly erect; anal spine large, larger than the dorsal spines; pubic bone feeble, lanceolate, not carinated, its edges raised, its median part thin; ventral spines moderate, serrulate, their length more than ⅓ that of the head; caudal lunate, long and narrow. Gill rakers long and slender; gill membranes free from the isthmus posteriorly. Olivaceous above, profusely punctulate, irregularly barred with darker; silvery below. Length 3 inches. Northern parts of Europe, and Atlantic coasts of America from Long Island to the Arctic Sea, also in tributaries of the Great Lakes, and northward to the Saskatchewan and Alaska, where it abounds in the mountain lakes and streams; a widely distributed species, found in both fresh and brackish waters. (*pungitius*, pricking.)

*Gasterosteus pungitius*, Linnæus, Syst. Nat., Ed. x, 296, 1758, Europe; after *Gasterosteus aculeis in dorso decem*, Artedi; Walbaum, Artedi Pisc., 1792, 446; Günther, Cat., i, 6, 1859; Jordan & Gilbert, Synopsis, 393, 1883.

*Pygosteus pungitius*, Eigenmann, Proc. Ac. Nat. Sci. Phila., 1886, 235.

*Gasterosteus lævis*, Cuvier, Règne Animal, Ed. 2, ii, 170, 1829, streams of France.

*Gasterosteus occidentalis*, Cuvier & Valenciennes, Hist. Nat. Poiss., iv, 509, 1829, Newfoundland; not *G. occidentalis* of Linnæus, which is an unrecognized species, probably of *Carangidæ*.

*Gasterosteus concinnus*,* Richardson, Fauna Bor.-Amer., iii, 57, 1836, Saskatchewan River and Great Bear Lake; DeKay, N. Y. Fauna: Fishes, 68, 1842.

*Gasterosteus mainensis*,† Storer, Bost. Journ. Nat. Hist., i, 1837, 464, Kennebec County, Maine.

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*The names *concinnus* and *nebulosus* have been used for the fresh-water form of the northern inland lakes, but a comparison of specimens from Calumet River, Illinois, with others from Massachusetts shows no tangible difference. We have seen none with less than 9 dorsal spines. Nor can we separate the American form called *occidentalis* from the European *pungitius*. Bean records no difference between Hudson Bay specimens and those from Massachusetts.

†These two names may represent a distinct subspecies, *mainensis*, distinguished by the presence of 7 free dorsal spines.

*Gasterosteus nebulosus*,[*] AGASSIZ, Lake Superior, 310, pl. 4, fig. 4, 1850, Lake Superior.
*Gasterosteus dekayi*, AGASSIZ, Lake Superior, 311, 1850, New York.
*Gasterosteus lotharingus*, BLANCHARD, Poiss. France, 244, 1866, Gordon, Lorraine.
*Gasterosteus breviceps*, BLANCHARD, Poiss. France, 245, 1866, Caen, France.
*Gasterostea blanchardi*,† SAUVAGE, Révision des Épinoches, 32, 1874, New York.

Represented in Greenland and the far north by

### 1097a. PYGOSTEUS PUNGITIUS BRACHYPODA (Bean).

D. X–I, 10; A. I, 10. Similar to *P. pungitius*, but the ventral spines very short, their length a little less than ⅛ that of head. Mountain streams and lakes, about Baffins Bay;[*] locally abundant; not seen by us. (*βραχύς*, short; *πούς*, foot.)

*Gasterosteus pungitius brachypoda*, BEAN, Bull. U. S. Nat. Mus., XV, 129, 1879, Oosooadlin Mountain, Cumberland Gulf, Greenland. (Type, Nos. 21738, 21766, etc. Coll. Kumlein.) JORDAN & GILBERT, Synopsis, 394, 1883; EIGENMANN, *l. c.*, 236.

## 338. GASTEROSTEUS (Artedi) Linnæus.

### (STICKLEBACKS.)

*Gasterosteus* (ARTEDI) LINNÆUS, Syst. Nat., X, 1758, 489, (*aculeatus*).
*Gasteracanthus*, PALLAS, Mém. Ac. St. Petersb., III, 325, 1811, (*cataphractus*).
*Leiurus*, SWAINSON, Nat. Hist. Class'n Fishes, II, 242, 1839, (*gymnurus*).

Sticklebacks with the innominate bones coalescent on the median line of the belly, behind and between the ventral fins, forming a triangular or lanceolate plate. Gill membranes united to the isthmus. Tail slender, and usually keeled. Skin variously covered with bony plates. Dorsal spines 3 in number, strong, with nondivergent bases. Species numerous. Fresh waters and shores of all northern regions; the species highly variable, those found in the sea usually with the body completely mailed, the fresh and brackish water forms variously mailed or even altogether naked. It is probable that the reduction in armature is in some degree connected with life in fresh waters. It is also probable that the partially naked fresh-water forms of Europe and northeastern and northwestern America have been in each case derived from the mailed marine forms of the same region. In Europe, the mailed and partly naked forms are scarcely separable as varieties. In western America, the division is better established, and the naked and partially naked forms seem definable as distinct species, each with large variation within its range. (*γαστήρ*, belly; *ὀστέον*, bone.)

*a.* Species of the eastern Atlantic, robust, with short dorsal spines, each one when depressed not reaching the next. ACULEATUS, 1098.
*aa.* Specie of the western Atlantic, more slender, with longer spines. BISPINOSUS, 1099.
*aaa.* Species of the eastern Pacific, robust, the marine forms with long spines.
  *b.* Species marine, the body wholly mailed, the plates well developed throughout. CATAPHRACTUS, 1100.
  *bb.* Species of fresh or brackish waters, not wholly mailed, or with the posterior plates very small. WILLIAMSONI, 1101.

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[*] The common Alaskan form referred by Dr. Bean to this subspecies, seems to be nearer the typical *pungitius*, having the ventral spines nearly half length of head.

### 1098. GASTEROSTEUS ACULEATUS, Linnæus.

(European Stickleback; Burnstickle.)

Head 3¼ to 3½; depth 4; eye 3¾ to 4; snout 3. Body rather stout, head short, snout short, mouth oblique, maxillary not reaching eye; caudal peduncle depressed, keeled or not. Dorsal spines short and stout, usually a little shorter than snout and strongly serrate; ventral spines about as long as from tip of snout to pupil, serrate on each side, and with strong basal cusp; ventral plate broad and long, longer than ventral spines or about as long as snout and eye; processes from shoulder girdle widely divergent inclosing a large triangular area. Lateral armature variable, the plates 6 to 32, usually none on caudal peduncle; in fresh-water specimens caudal keel generally present but fleshy; in unarmed specimens the posterior plates when présent on the caudal peduncle are much reduced in size. The variation in the sticklebacks of Europe is very great, as was pointed out by Day * some years ago. This is also shown by the studies which Dr. Boulenger has recently made of the sticklebacks of England. The various partly naked forms are not susceptible of definition even as varieties. Coasts and streams of northern Europe; abundant. We include this form in the present memoir on the supposition that the mailed form in Greenland, *Gasterosteus loricatus*, Reinhardt, belongs to it. (*aculeatus*, spined.) (Eu.)

*Gasterosteus aculeatus*, LINNÆUS, Syst. Nat., Ed. x, 1758, 489, Europe; completely mailed.

*Gasterosteus trachurus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IV, 481, 1829, France; completely mailed; 31 plates.

*Gasterosteus ponticus*, NORDMANN, in Demidoff, Voy. Russ. Merid., III, 357, Tauria and Black Sea; plates fewer than in *aculeatus*.

*Gasterosteus semiarmatus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IV, 493, 1829, Havre; 14 plates.

*Gasterosteus semiloricatus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IV, 494, 1829, Baillon; 13 plates.

*Gasterosteus leiurus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IV, 481, 1829, Seine; 6 plates.

? *Gasterosteus loricatus*, REINHARDT, Fauna Grœnlandica, 32, 37, 1837, Greenland; fully armed; may be *G. bispinosus*.

*Gasterosteus bailloni*, BLANCHARD, Poissons des eaux douces de France, 231, 1866, Abbeville.

*Gasterosteus neustrianus*, BLANCHARD, Poissons des eaux douces de France, 220, 1866, Harfleur; armature interrupted.

*Gasterosteus argentissimus*, BLANCHARD, Poissons des eaux douces de France, 232, 1866, Avignon; 6 plates.

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* Dr. Francis Day observes: "It appears remarkable how many species of sticklebacks have been named, outnumbering even those of the *Salmonidæ* of the fresh waters, and it becomes a first consideration whether any general principles are perceptible in the distribution of these species or varieties. It is in the ocean more than in fresh waters that we must seek the spiny-rayed fishes; and similarly it is on the seaboards or skirts of the ocean that we must look for sticklebacks in which the armature of the sides is most developed (as in the variety *trachurus*), while such as have the free portion of the tail unarmed are farthest inland or on elevated plateaus; while in the center of Ireland I have captured examples of *G. pungitius* in which the armature had so decreased that the ventral spine was entirely absent. It has been pointed out (Phil. Mag., 1834, v, p. 299) that the variety on the continent with the shortest spine or the most defenseless form, comes from Tuscany, and is peculiar to still waters, where it would have the fewest enemies, and here it attains to a great size. Taking large numbers of Irish specimens I found considerable differences in the length of the ventral spines and pubic plates, conclusively showing that such characters afford no reliable data.

"Heckel and Kner, in their account of the fishes of Austria, did not admit the foregoing to be more than varieties differentiated by the development of the lateral scutes or plates, which they found varied in number between 3 and 28."—*Day*.

*Gasterosteus elegans*, BLANCHARD, Poissons des eaux douces de France, 234, 1866, Cadillac and Langou; 6 plates.

*Gasterosteus argyropomus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IV, 498, 1829, Florence; 3 plates.

*Gasterosteus brachycentrus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IV, 499, 1829, Florence; 4 plates.

*Gasterosteus tetracanthus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IV, 499, 1829, Florence; 4 plates; 4 dorsal spines.

*Gasterosteus algeriensis*, SAUVAGE, Révision des Épinoches, 17, 1874, Algiers; 6 plates.

*Gasterosteus islandicus*, SAUVAGE, Révision des Épinoches, 20, 1874, Iceland; 5 plates.

*Gasterosteus gymnurus*, CUVIER, Règne Animal, Ed. 2, II, 170, 1829,

*Gasterosteus spinulosus*, JENYNS & YARRELL, Manual, 350, Edinburgh; 4 dorsal spines.

*Gasterosteus aculeatus*, JORDAN & GILBERT, Synopsis, 395, 1883.

### 1099. GASTEROSTEUS BISPINOSUS, Walbaum.

(COMMON EASTERN STICKLEBACK.)

Head 3½; depth 4½. D. II-I, 13; A. I, 9; lateral plates 33. Head rather long. Caudal peduncle very slender, covered with plates similar to those on the body, and provided with a conspicuous keel. Processes from shoulder girdle below, covering most of the breast, leaving a narrow naked area between them. Opercle finely striate. Large rugose bony plates on each side of base of dorsal spines, the latter joined to them by a hinge and capable of being firmly set, like the spines, of catfish. Naked area in front of pectorals large; pelvic bone lanceolate; ventral spine with a basal cusp; spines all serrate, those of anal and soft dorsal small. Dark greenish above; sides silvery, or yellow; membranes of ventrals often red. Length 4 inches. The stickleback of the east coast of North America seems to differ from the European *Gasterosteus aculeatus* in having higher spines and more slender body. The dorsal spines when depressed each extends beyond the base of the next. In other respects *G. bispinosus* does not differ materially from *G. aculeatus.* The typical marine form has the body fully plated as in the marine form of *G. aculeatus*; its partly naked fresh-water varieties (*atkinsii, cuvieri, wheatlandi*) are better defined than those of *G. aculeatus*, and are less abundant, being still rare in collections. Labrador to New Jersey, near the coast, in salt water; very common in New England. (*bis*, two; *spinosus*, spined.)

*Two-spined Stickleback*, PENNANT, Arctic Zoölogy, II, 385, 1784; after FORSTER; no locality specified.

*Gasterosteus bispinosus*, WALBAUM, Artedi Pisc., 450, 1792; after PENNANT; said to be "New York," but more likely Hudson's Bay; JORDAN & GILBERT, Synopsis, 395, 1883.

*Gasterosteus biaculeatus*, SHAW, Zoöl., IV, 608, 1839; after PENNANT, as above; STORER, Hist. Fishes of Mass., 88, plate VIII, figs. 2 and 3, 1867.

Represented in the rivers of Maine and Quebec by

### 1099a. GASTEROSTEUS BISPINOSUS ATKINSII (Bean).

Head 3⅛; depth 4⅘; eye 3¼; snout 3, a little greater than eye, pointed; mouth oblique, maxillary shorter than eye. D. II-I, 12; A. I, 8. Lateral plates variable, usually from 10 to 22 in number, the posterior ones small and weak; caudal peduncle depressed, keel usually developed. First and second dorsal spines long and slender, about as long as from tip of snout to pupil, slightly serrate; pectoral spine also long and slender, nearly as long as snout and eye, strongly serrate, and with cusp at base on outer side; ventral plate long and narrow, about as long as the ventral spines. Pectoral plate broad and deep. Upper part of body dark; more or less distinct, dark cross bands on posterior part of body, darkest on caudal peduncle; base of caudal fin with a black bar; under parts silvery except on caudal peduncle, where there are a few dark punctulations. Quebec; Maine. (Named for Mr. Charles G. Atkins, Supt. U. S. Fish Commission Station, Craig Brook, Maine.)

*Gasterosteus atkinsii*, BEAN, Proc. U. S. Nat. Mus., 1879, 67, Schoodic Lakes, Maine. (Type, No. 22492. Coll. Atkins.)

Represented along the Atlantic Coast in brackish water from Newfoundland to Cape Cod by

### 1099b. GASTEROSTEUS BISPINOSUS CUVIERI (Girard).

Head 4; depth 5½; eye 3½. D. II–I, 12; A. I, 8. Body slender and compressed. Anterior part of body with four lateral plates, the first one largest; posterior half of body naked. Tail keeled. Smooth space in front of the pectoral large and subcircular. Posterior processes from the shoulder girdle strong, divergent, leaving a naked space between them; mouth small and oblique, the maxillary not reaching eye; dorsal spines long, acute, and serrate, about as long as distance from tip of snout to pupil; ventral spines slender, as long as snout and eye; they also are serrate and provided with a cusp at the base; ventral plate long and narrow, as long as from tip of snout to posterior edge of preopercle. Color uniform, grayish brown on head, back, and posterior half of body; neck, opercle, and naked space in front of pectorals silvery, minutely dotted with brown. (Girard.) East coast of North America from Labrador to Massachusetts, in fresh or brackish water, not common except northward. (Named for Baron Georges Léopold Chrétien Frédéric Dagobert Cuvier, 1769–1832, the father of comparative anatomy and, therefore, of classification in ichthyology.)

? *Gasterosteus dimidiatus*, REINHARDT, Fauna Grœnlandica, 32, 37, 1837, Greenland; may be a form of *G. aculeatus*.

*Gasterosteus cuvieri*, GIRARD, in Storer's Fishes of Nova Scotia and Labrador, 254, plate VII, fig. 1, 1849, Bras d'Or, Red Bay, Labrador.

*Gasterosteus wheatlandi*, PUTNAM, Proc. Essex Inst., V, 4, 1867, Nahant; EIGENMANN, *l. c.*, 246.

### 1100. GASTEROSTEUS CATAPHRACTUS (Pallas).

(ALASKA STICKLEBACK; SALMON KILLER.)

Head 3 to 3¼; depth 4 to 4½; eye 3¼ = snout. D. II–I, 12; A. I, 8. Body slender, compressed; head small and pointed, mouth oblique, maxillary not reaching eye; caudal peduncle depressed, keeled. Processes from shoulder girdle slightly divergent, leaving a narrow naked area on breast; naked area in front of pectorals long and deep. Dorsal spines long and slender, the length equaling distance from snout to pupil; third dorsal and anal spines very small, curved; ventral spines long, slender, as long as snout and eye, or even longer in some specimens; serrate at base and with basal cusp; ventral plate as long as spine in many specimens, narrow, the greatest width 2 to 2½ in length. Lateral armature complete, the plates gradually reduced in size posteriorly, forming a distinct caudal keel. Dark grayish or bluish black above, silvery below, with a few dark punctulations, thickest on caudal peduncle and near tip of ventral spines. San Francisco to Alaska and Kamchatka; very abundant northward; rarely or never entering fresh water. Very close to *Gasterosteus bispinosus*, and only distinguishable by the more robust form; probably both of them to be regarded as geographical subspecies of *Gasterosteus aculeatus*, and perhaps not really recognizable at all. (*κατάφρακτος*, *cataphractus*, mailed.)

*Gasteracanthus cataphractus*, Pallas, Mém. Acad. Petersb., III, 325, 1811, Kamchatka.
*Gasterosteus obolarius*, Cuvier & Valenciennes, Hist. Nat. Poiss., IV, 500, 1829, Kamchatka.
*Gasterosteus insculptus*, Richardson, Last Arctic Voyage, 10, plate XXV, figs. 1, 2, and 3, 1854, Northumberland and Puget sounds.
*Gasterosteus serratus*, Ayres, Proc. Cal. Acad. Sci., 1855, 47, San Francisco; Sauvage, Révision des Épinoches, 13, 1874.
*Gasterosteus intermedius*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 135, Cape Flattery.
*Gasterosteus aculeatus cataphractus*, Jordan & Gilbert, Synopsis, 396, 1883.

### 1101. GASTEROSTEUS WILLIAMSONI, Girard.

Head 3¼ to 3½; depth 3¼ to 4; eye 3½ to 4; snout = eye. Dorsal II, I, 10; anal I, 8. Body short and deep, not especially compressed; head small; mouth small, not quite as oblique as in var. *microcephalus*; maxillary not reaching eye; caudal peduncle deep and stout, not keeled. Processes from shoulder girdle widely divergent, inclosing a large triangular area. Naked area in front of pectoral narrow. First and second dorsal spines very short and weak, 1½ to 2 in distance from tip of snout to pupil, the first not reaching the second when depressed, and the second falling far short of the third; ventral spines short and stout, about equal to snout, broadened at base, serrate on outer side, cusp sometimes present; ventral plate broad, longer than spines, about as long as snout to posterior edge of pupil. Sides nearly always without armature, occasionally 2 or 3 anterior plates developed, which is accompanied by a greater development of the dorsal and ventral spines. Dusky, sides paler and mottled. Males with the head bright coppery red. This description is based upon numerous specimens collected in Santa Ana River, at Colton, California, by Dr. Charles H. Gilbert. Fresh-water streams of southern California; locally very abundant, replacing *microcephalus* inland; Williamson Pass; San Bernardino (Rosa Smith). This form is apparently derived from *G. microcephalus*, and is usually well distinguished. (Named for Lieut. R. S. Williamson, a member of the United States Pacific Railroad Survey, by whom the species was first obtained.)

*Gasterosteus williamsoni*, Girard, Proc. Ac. Nat. Sci. Phila., 1854, 133, Williamson Pass,* California; (Coll. Lieut. Williamson); Girard, Pacific R. R. Surv., x, 93, 1858; Sauvage, Révision des Épinoches, 25, 1874; Rosa Smith, Proc. U. S. Nat. Mus., 1883, 217;† Eigenmann, *l. c.*, 247.

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* This pass is not recognized on the maps, but it is near the present village of Saugus, Ventura County, California.

† Specimen said to have come from an artesian well at San Bernardino, California.

Represented in coastwise streams of California and northward by

### 1101a. GASTEROSTEUS WILLIAMSONI MICROCEPHALUS (Girard).

(California Stickleback.)

Head 3 to 3½; depth 3 to 3¾; eye 4; snout 3¼. Dorsal II–I, 11; anal I, 8. Body short, deep, moderately compressed. Caudal peduncle rather deep, not compressed, nor evidently keeled. Processes from shoulder girdle below widely diverging, leaving a triangular area on breast; naked area in front of pectorals smaller than in *cataphractus*. Dorsal spines stout, about as long as from tip of snout to pupil; third dorsal spine and anal spine small; ventral spines stout, about equaling distance from tip of snout to posterior rim of orbit, strongly serrate on outer side and with a distinct basal cusp; ventral plate shorter and broader than in *cataphractus*, about half as wide as long. Lateral armature variable; plates usually 5 or 6, but sometimes completely armed with 25 or 26; all intermediate numbers occasionally found, the anterior plates large, these followed by smaller ones; the posterior half usually unarmed; often the plates are reduced to one or two, or even entirely absent, especially in brook specimens; often again the whole length of the body is provided with plates, the posterior ones quite small, considerably smaller than corresponding plates in *cataphractus*, but forming a distinct keel. Usually specimens from the same stream are alike or nearly so, the variously armed forms having the nature of local varieties. The fully armed variety abounds in San Gregonio Creek, Pilarcitos Creek, and other streams of the west slope of the Sierra Morena, on the San Francisco peninsula. Olivaceous, silvery below; skin thickly punctulate; males blackish in spring, with coppery or golden luster. Pacific Coast of the United States, in streams and brackish waters; abundant southward, ranging from Alaska to Todos Santos in Lower California. Probably an offshoot from *Gasterosteus cataphractus*, but now apparently entirely differentiated. We have seen no intermediate forms, the fully mailed examples having smaller plates * than in *Gasterosteus cataphractus*. (*μικρός*, small; *κεφαλή*, head, but the head is unusually large for a stickleback.)

*Gasterosteus microcephalus*, Girard, Proc. Ac. Nat. Sci. Phila., 1854, 133, Four Creek (Kaweah River), a tributary of Tule Lake (Tulare Lake) San Joaquin Valley, California; Jordan & Gilbert, Synopsis, 395, 1883.

*Gasterosteus plebeius*, Girard, and *Gasterosteus inopinatus*, Girard, *l. c.*, 147, Presidio, California.

*Gasterosteus pugetti*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 135, Fort Steilacoom; Puget Sound.

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* "In *Gasterosteus microcephalus*, the number of lateral plates varies from 0 to 25 (excluding the keel). Where the larger number is present, they extend from the head to the keel on the caudal peduncle. When only the smaller number, they are above the ventral fins. The posterior plates are more likely to be absent than the anterior ones. The variations do not seem to bear any relation to the character of the stream, for in one of two similar streams 96 per cent. were found to be fully plated, while in the other none had more than seven plates. In another stream an equal number of each sort was taken. The number bears no relation to age. The caudal keel is, with scarcely an exception, confined to the fully mailed individuals." (Cloudsley Rutter, MS.)

## 339. APELTES, De Kay.

*Apeltes*, De Kay, New York Fauna: Fishes, 67, 1842, *nomen nudum*, (*quadracus*).
*Apeltes*, Jordan, Man. Vert., Ed. I, 249, 1876, (*quadracus*; genus characterized).

Body moderately elongate, somewhat compressed, the back elevated at the beginning of the soft dorsal fin, thence declining in nearly a straight line to tip of snout. Tail very slender, not keeled. No bony dermal plates; the skin naked. Innominate bones not joined on the median line but separated, forming a bony ridge on each side of the abdomen, below which the strong ventral spines are depressible. Chest mostly bony; bare area in front of pectorals small, but distinct. Gill rakers rather short. Gill membranes attached to the isthmus, without free edge. Free dorsal spines 3, strong, the first the longest, directed to one side; the next two directed toward the other side at different angles; attached spine of dorsal and anal well developed; a bony ridge on each side of the spinous dorsal. American. (ἀ, privative; πέλτη, shield.)

### 1102. APELTES QUADRACUS (Mitchill).

Head 4; depth 4. D. III–I, 11; A. I, 8. Trunk oblong; head pointed; caudal peduncle very long and slender, not keeled, about 5 in length. Mouth small, horizontal; maxillary not reaching to eye; teeth slender, in a single series. No bony dermal plates along sides. Scapula forming a small granulated postopercular plate. Innominate bones wide apart; the area between them flat, so that a section of the fish is triangular. Gill membrane broadly united to the isthmus. Free dorsal spines divergent; the spines slender, pointed, slightly serrate; distance between first and third spine much less than that between third and fourth; the first extending beyond base of third; caudal long, narrow; anal similar to soft dorsal and coterminous with it; its spine under third ray of dorsal; ventral spines strong, subterete; serrate on both edges and covered by skin to near tip; when the ventral spines are set they point almost sidewise, when depressed they lie along inside of innominate bones. Brownish olive above, mottled with darker; silvery below; male almost black; ventrals with the membrane red in spring. Length 1½ to 2½ inches. Maine to New Jersey, in salt water; very abundant northward. (*quatuor*, four; *acus*, spine.)

*Gasterosteus quadracus*, Mitchill, Trans. Lit. and Phil. Soc., I, 1815, 430, New York; Günther, Cat., I, 7, 1859.
*Gasterosteus apeltes*, Cuvier & Valenciennes, Hist. Nat. Poiss., IV, 505, 1829, no locality.
*Gasterosteus millipunctatus*, Ayres, Bost. Journ. Nat. Hist., 1842, 294, Old Man's Harbor, Long Island.
*Apeltes quadracus*, Jordan & Gilbert, Synopsis, 396, 1883; Eigenmann, *l. c.*, 242.

## Family XCIX. AULORHYNCHIDÆ.

Body elongate, nearly cylindrical, with a very slender, depressed caudal peduncle. Skin naked, with a few series of partly concealed plates. Mouth terminal, small, at the end of a tube which is about as long as the rest of the head, its base formed of the lengthened symplectic quadrate and pterygoid; teeth very small; premaxillary forming most of margin of mouth, the maxillary exposed at the corner. Branchiostegals 4. Gill* membranes slightly connected, free from the isthmus. Dorsal fin with many small, low, free spines, each of which is depressible in a groove; soft dorsal short, elevated in front; anal similar to the second dorsal, preceded by a single spine; caudal fin small, forked. An oblong, naked area in front of the pectorals. Ventrals subthoracic, very close together, inserted somewhat behind pectorals, I, 4. Vertebræ 25 + 29, those behind anal exceedingly compressed. Anterior vertebræ little enlarged. Genera 2; (*Aulorhynchus* and *Aulichthys*); species 2. Small fishes of the North Pacific, very close to the sticklebacks, intermediate between them and the trumpet-fishes. (*Aulorhynchidæ*, Gill, Proc. Ac. Nat. Sci. Phila., 1862, 233.)

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| *a.* Skin of head naked; pectoral fins emarginate. | AULORHYNCHUS, 340. |

## 340. AULORHYNCHUS, Gill.

*Aulorhynchus*, GILL, Proc. Ac. Nat. Sci. Phila., 1861, 169, (*flavidus*).
*Auliscops*, PETERS, Berliner Monatsberichte, 1866, 570, (*spinescens*).

Body very long and slender, almost cylindrical; caudal peduncle elongate, tapering, much depressed, especially posteriorly. Skin naked, with a series of small, rugose shields, one on each side of the lateral line, a dorsal row to which the spines are attached, and a row on the lower edge of caudal peduncle. These plates closely resemble the dorsal plates, having a groove through the middle in which for a short distance behind the anal there lies a fin ray, besides small pores, probably mucous pores. Lateral line present. Head not mailed. Mouth small, horizontal, at the end of a tube which is slightly longer than the rest of the head. Premaxillary bones much expanded, with long and slender processes; lower jaw projecting, with a flap at symphysis. Teeth in the jaws rather sharp, almost in one series; palate toothless. Dorsal spines numerous, entirely separate, equal and very short, the first inserted above the pectorals; dorsal and anal fins posterior, nearly equal, oblong, elevated in front; caudal fin small, emarginate; pectoral fins emarginate, the upper and lower rays longest; ventrals not much behind pectorals, each with 1 spine and 4 rays. (αὐλός, a tube; ῥύγχος, snout.)

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* The gill formula is as follows according to Mr. Rutter:

| | Basi-branchial. | Hypo-branchial. | Cerato-branchial. | Epi-branchial. | Pharyngo-branchial. |
|---|---|---|---|---|---|
| 1 | Present. | Present. | Present. | Present. | Present. |
| 2 | ------------- | Present. | Present. | Present. | Present. |
| 3 | ------------- | ------------- | Present. | Present. | Present. |
| 4 | ------------- | ------------- | Present. | ------------- | Present. |

### 1103. AULORHYNCHUS FLAVIDUS, Gill.

Head 4; depth 16. D. XXV–9; A. I, 9; V. I, 4. Gill rakers slender. Dorsal spines minute, much shorter than pupil. Caudal peduncle longer than head. Tawny, with about 20 darker cross blotches on the back; minutely punctulate above; opercula and antepectoral region with bright golden or coppery luster, bordered above by a blackish band. Coast of California from San Nicolas Island and Monterey northward to Sitka, Alaska; rather rare; a curious little fish, like a stickleback in structure, but with the produced snout of *Fistularia*. (*flavidus*, yellowish.)

*Aulorhynchus flavidus*, GILL, Proc. Ac. Nat. Sci. Phila., 1861, 169, Coast of Washington. (Coll. Dr. Kennerly); STEINDACHNER, Ichth. Beitr., v, 153, 1876; JORDAN & GILBERT, Synopsis, 391, 1883.

*Auliscops spinescens*, PETERS, Berliner Monatsber., 570, 1866.

## Family C. AULOSTOMIDÆ.

### (THE TRUMPET-FISHES.)

Body compressed, elongate, covered with small ctenoid scales. Lateral line continuous. Head long; mouth small, at the end of a long, compressed tube. Lower jaw prominent, with a barbel at the symphysis. Premaxillary feeble, not protractile; maxillary broad, triangular, with a supplemental bone. Teeth minute, in bands, on lower jaw and vomer. Branchiostegals 4. Gills 4, a slit behind the fourth. Pseudobranchiæ well developed. Gill rakers obsolete. Gill membranes separate, free from the isthmus. Air bladder large. Spinous dorsal present, of 8–12 very slender free spines; soft dorsal and anal rather long, similar, posterior, with 23 to 28 rays each; caudal small, rhombic, the middle rays longest, but not produced into a filament; ventrals abdominal, of 6 rays, all articulated; pectorals broad, rounded, the space in front of them scaly. First four vertebræ elongated. Two pyloric cœca. A single genus, with two species, found in tropical seas. (*Fistulariidæ*, part, genus *Aulostoma*, Günther, Cat., III, 535–538, 1861.)

### 341. AULOSTOMUS, Lacépède.

*Aulostomus*, LACÉPÈDE, Hist. Nat. Poiss., v, 357, 1803, (*chinensis*).
*Aulostoma*, SCHLEGEL, Fauna Japonica, 320, 1842; change of spelling.
*Polypterichthys*, BLEEKER, Ternate II, 608, (*valentini* = *chinensis*).
*Solenostomus*, GRONOW, Cat. Fishes, Ed. Gray, 146, 1854, (*chinensis*).

Characters of the genus included above. (*αὐλός*, tube; *στόμα*, mouth.)

*a.* Base of soft dorsal and anal not black; each fin with a black band parallel with its base.
  *b.* Eye 2 to 2½ in postorbital part of head; ground color reddish; silvery lateral streaks not all below lateral line. MACULATUS, 1104.
  *bb.* Eye 3½ in postorbital part of head; ground color brown; lateral silvery streaks all below the lateral line. CINEREUS, 1105.

### 1104. AULOSTOMUS MACULATUS, Valenciennes.

### (TROMPETERO.)

Head 3; eye 2 to 2½ in postorbital part of head. D. X–23; A. 25; V. 6. Lower jaw prominent, keeled, with a small barbel at the symphysis;

premaxillary slender; maxillary broad; triangular patches of minute teeth on lower jaw, vomer, palatines, gill arches, and pharyngeals. Intestinal canal short; two pyloric cœca. Olivaceous, with one or two series of brown or blue dots along each side of the back; another irregular series from the preoperculum along each side of the belly to the anal fin; three or four silvery lines on each side of abdomen, replaced on the head by irregular oblique streaks; anterior part of dorsal and anal with a horizontal black band, parallel with base of fin but remote from it; caudal fin usually with two round black spots; ventral fins plain, spotted. (Günther.) Caribbean Sea, north to southern Florida; rather common southward. (*maculatus*, spotted.)

*Aulostoma maculatum*, VALENCIENNES,* in Cuvier, Illust. Poissons, plate 92, fig. 2, about 1845; JORDAN & GILBERT, Synopsis, 390, 1883.

*Aulostoma coloratum*, MÜLLER and TROSCHEL, in Schomburgk, History Barbadoes, 673, 1848, Barbadoes; GÜNTHER, Cat., III, 536, 1861.

### 1105. AULSOTOMUS CINEREUS, Poey.

Head 3½; depth 14½; eye 14½ in head, 3½ in distance to gill opening. Dorsal X. Insertion of anal midway between ventral and caudal. Similar to *Aulostomus maculatus*, but the ground color brown instead of reddish; head with black and white points; trunk with black points; 6 pale longitudinal streaks all below the lateral line; (in *Aulostomus maculatus* there are 4 below, one on, and one above the lateral line); caudal greenish, with blackish spots, the angles yellowish. Cuba. (Poey.) One specimen known, now in the Museum of Berlin, perhaps a variation of *Aulostomus maculatus*. (*cinereus*, ashy gray.)

*Aulostoma cinereum*, POEY, Synopsis Pisc. Cub., 386, 1867, Cuba.

## Family CI. FISTULARIIDÆ.

### (THE CORNET-FISHES.)

Body extremely elongate, much depressed, broader than deep. Scaleless, but having bony plates present on various parts of the body, mostly covered by the skin. Head very long, the anterior bones of the skull much produced, forming a long tube, which terminates in the narrow mouth; this tube formed by the symplectic, proethmoid, metapterygoid, mesopterygoid, quadrate, palatines, vomer, and mesethmoid. Both jaws, and usually the vomer and palatines also, with minute teeth; membrane uniting the bones of the tube below, very lax, so that the tube is capable of much dilation. Post-temporal coössified with the cranium. Branchiostegals 5 to 7; gills 4, a slit behind the fourth.

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* Poey remarks, "Dr. Günther places *Aulostoma maculatum* in the synonymy of *Aulostoma coloratum*, but this latter name seems later, since Valenciennes (Cuv. & Val., XIX, 54) quotes in 1846, the plate 98 of the Illustrated Edition of Cuvier."

Gill[*] membranes separate, free from the isthmus; gill rakers obsolete. Basibranchial elements wanting. Pseudobranchiæ present. Air bladder large. Spinous dorsal fin entirely absent; soft dorsal short, posterior, somewhat elevated; anal fin opposite it and similar; caudal fin forked, the middle rays produced into a long filament; pectorals small, with a broad base, preceded by a smooth area as in *Gasterosteidæ*; pectoral ossicles 3; interclavicles greatly lengthened; supraclavicles very small; ventral fins very small, wide apart, abdominal (through partial atrophy of the girdle, by which they lose connection with the interclavicles), far in advance of the dorsal, composed of 6 soft rays. Pyloric cœca few; intestine short. Vertebræ very numerous (4 + 44 to 49 + 28 to 33); the first four vertebræ very long. Fishes of the tropical seas, related to the sticklebacks in structure, but with prolonged snout and different ventral fins. A single genus, with 3 species. (*Fistulariidæ*, part, genus *Fistularia*, Günther, Cat., III, 529–535, 1861.)

## 342. FISTULARIA, Linnæus.

(TRUMPET-FISHES.)

*Solenostomus*, KLEIN, Missus IV, 23, 1740, (nonbinomial).
*Fistularia*, LINNÆUS, Syst. Nat., Ed. x, 1758, 312, (*tabacaria*).
*Cannorhynchus*, CANTOR, Malayan Fishes, 211, 1850, (*tabacaria*; *Fistularia* being regarded as preoccupied by Donati in 1750, for a pre-Linnæan genus of Polyps).
*Flagellaria*, GRONOW, Cat. Fishes, 146, 1854, (*fistularis* = *tabacaria*).

Characters of the genus included above. The bony shields, characteristic of this genus, are the following:[†]

1. A narrow strip along the median line of the back behind the skull (confluent neural spines).

2. The pair of broader lateral dorsal shields are peculiar bones, separated processes of the occipital bone. These shields are the longest, provided anteriorly with a ridge, which is prolonged and extends far backward between the muscles of the back. This ridge is flexible, and does not interfere with the lateral movements of the fish; it appears to serve as a base for the attachment of muscular fibers.

3. The narrow shield on the side is the postclavicle, its posterior part being dilated and fixed to the lateral dorsal shields.

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[*] The gill formula is, according to Mr. Rutter:

| | Hypobranchial. | Ceratobranchial. | Epibranchial. | Pharyngobranchial. |
|---|---|---|---|---|
| 1 | Present. | Present. | Present. | Present. |
| 2 | Present. | Present. | Present. | Present. |
| 3 | Present. | Present. | Present. | Present. |
| 4 | ---------------- | Present. | ---------------- | ---------------- |

[†] According to Dr. Günther, the wording somewhat altered by Mr. Cloudsley Rutter, who has made a special study of these fishes.

4. The ventral shields are the interclavicles; their posterior half is broadest, much pitted inferiorly; they are narrower before the middle, leaving a free lanceolate space between them, and are again a little widened anteriorly, where they join the clavicle and urohyal. These plates extend as far backward as the anchylosed vertebræ. (*fistula*, a tube or pipe.)

*a.* Upper lateral edges of snout with few serrations or none; body with blue spots. TABACARIA, 1106.

*aa.* Upper lateral edges of snout sharply serrated; body with few blue spots, or none.

  *b.* Two middle ridges on snout well separated, diverging on anterior half of length of snout, converging finally on its foremost part; skin nearly smooth. DEPRESSA, 1107.

  *bb.* Two middle ridges on snout close together and parallel on anterior half of its length, slowly converging forward from the middle; skin rough. PETIMBA, 1108.

### 1106. FISTULARIA TABACARIA, Linnæus.

(TRUMPET-FISH; TROMPETERO.)

Head $2\frac{4}{5}$; mandible about 4 in snout; snout $3\frac{3}{4}$ in length of body. D. 14; A. 13. Mouth slightly oblique, lower jaw the longer, overlapping the upper; snout much prolonged, tapering but little forward; its edges with fine serrations or none. Margin of orbit with sharp compressed points in front and behind. Reddish brown above, variegated with numerous large, unequal, oblong, pale-blue spots on the sides and back, arranged in series. West Indies and neighboring seas, generally common; occasional northward to Carolina and Florida, or even to Long Island. Reaches a length of 6 feet. (*tabacarius*, from tobacco; having the form of a pipe.)

*Petimbuaba*, MARCGRAVE, Hist. Brazil, 148, 1648.

*Fistularia tabacaria*, LINNÆUS, Syst. Nat., Ed. x, 312, 1758, Tropical America; BLOCH, Ichthyologia, plate 387, fig. 1, 1794; VALENCIENNES, in CUVIER, Règne Animal, Illust. Poissons, pl. 92, fig. 1, 1845 to 1850; GÜNTHER, Cat., III, 529, 1861; JORDAN & GILBERT, Synopsis, 389, 1883.

*Fistularia neoboracensis*, MITCHILL, Trans. Lit. and Phil. Soc., I, 1815, 437, New York.

*Aulastome marcgravii*, CASTELNAU, Anim. Nouv. Amer. Sud, 30, 1850, Bahia; Rio Janeiro.

*Flagellaria fistularis*, GRONOW, Cat. Fish., 146, 1854, American Ocean.

### 1107. FISTULARIA DEPRESSA, Günther.

(CORNETA.)

Head $2\frac{3}{4}$; depth 10 in head; snout $3\frac{1}{4}$ in body. D. 15; A. 14. Bones of the head less deeply sculptured than in *F. serrata*, interorbital space slightly concave with median ridges. Two middle ridges on upper surface of snout not very close together, nearest together mesially; lateral margins of snout slightly serrate, the anterior half entire; lower margins entire, not showing from above, diverging again on the anterior half of length of snout, converging again finally on the foremost part. Body much depressed, nearly smooth, the skin being scarcely rough. Color nearly plain brown, the blue spots wanting. Length 2 feet. Recorded from the East Indies, Australia, China, Panama, and Lower California; abundant in the Gulf of California and southward to Panama. (*depressus*, depressed.)

*Fistularia depressa*, GÜNTHER, Report on Shore Fishes, Challenger Report, 69, pl. 32,* fig. D, 1880, type from Sulu Archipelago; other specimens from Natal; Zanzibar; Amboyna; China; New Guinea; New South Wales; Fiji Islands; California.

### 1108. FISTULARIA PETIMBA, Lacépède.

Head 2⅔; snout 3⅗. D. 14; A. 13. Interorbital space concave; the 2 middle ridges on the upper surface of the snout run close and parallel to each other along the anterior half of the length of the snout, being farthest apart near the middle; lateral margin of snout strongly serrated, except on its anterior third. Body moderately depressed, with minute asperities which render the skin rough to the touch. Color nearly uniform brown; fins reddish. Length 5 feet. Western Pacific, and other warm seas, also recorded from the Bermudas (J. M. Jones) and from Cuba (Poey). (*Petimbuaba*, Portuguese name of *Fistularia tabacaria.*)

PIPE, John White, Voyage New South Wales, pl. 64, fig. 2.

*Fistularia tabacaria*, var., BLOCH, Ichth., pl. 387, fig. 2, 1794, "Coll. Linke at Leipzig;" wrongly figured as spotted with blue; snout serrate; 2 caudal filaments.

*Fistularia petimba*, LACÉPÈDE, Hist. Nat. Poiss., v, 349, 1803, (excl. syn.), New Britain, Isle of Reunion, equatorial Pacific; based on specimens and manuscripts of Commerson; snout serrate; body immaculate.

*Fistularia serrata*, CUVIER, Règne Animal, Ed. I, 349, 1817 (after BLOCH); GÜNTHER, Cat., III, 533, 1861; GÜNTHER, Shore Fishes, Challenger, 68, pl. 32, fig. C, 1880; JORDAN & GILBERT, Synopsis, 390, 1883.

*Fistularia immaculata*, CUVIER, Règne Animal, Ed. I, 349, 1817, Sea of the Indies; after COMMERSON and JOHN WHITE.

*Fistularia commersonii*, RÜPPELL, Neue Wirbelthiere, 142, 1834, Red Sea.

## Family CII. MACRORHAMPHOSIDÆ.

### (THE SNIPEFISHES.)

Body compressed, oblong, or elevated, covered with small, rough scales; no lateral line; some bony strips on the side of the back and on the margin of the thorax and abdomen, the former sometimes confluent into a shield. Bones of the skull much prolonged anteriorly, forming a long tube which bears the short jaws at the end; no teeth. Gill openings wide; branchiostegals 4. Branchihyals and pharyngeals mostly present, the fourth superior branchihyal and the first and fourth superior pharyngeals only wanting. Two dorsal fins, the first of 4 to 7 spines, the second of which is very long and strong; soft dorsal and anal moderate; ventral fins small, abdominal, of 1 spine and 5 soft rays; pectorals short; caudal fin emarginate, its middle rays not produced. Air bladder large; pseudobranchiæ present. Gills 4, a slit behind the fourth; vertebræ about 24, the four anterior ones much lengthened; no pyloric cœca; intestinal canal short. Three or more species, chiefly of the Old World, one of them straying to America, placed in two genera, *Macrorhamphosus* and *Centriscops*. (*Centriscidæ*, part, genus *Centriscus*,* Günther, III, 518–524, 1861.)

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* In this figure the lower lateral ridge appears outside of the upper or serrated ridge. This is due to an artificial depression of the expansible beak. In other respects the California species agrees with Günther's figure of the type from Sulu Archipelago.

*a.* Body oblong, graduating into the caudal peduncle; back straight; dorsal spines about 7.
MACRORHAMPHOSUS, 343.

## 343. MACRORHAMPHOSUS, Lacépède.

(SNIPEFISHES.)

*Macrorhamphosus*, LACÉPÈDE, Hist. Nat. Poiss., v, 136, 1803, (*cornutus* = *scolopax*).
*Centriscus*, CUVIER, Règne Anim., Ed. I, II, 350, 1817, (*scolopax*; not *Centriscus*, *L.*).
*Macrognathus*, GRONOW, Cat. Fishes, 147, 1854, (*scolopax*).
*Orthichthys*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 234, (*velitaris*).

Body oblong, graduating into the caudal peduncle; back straight; dorsal spines about 7. Characters otherwise included above. (*μακρός*, long; *ῥάμφος*, snout.)

### 1109. MACRORHAMPHOSUS SCOLOPAX (Linnæus).

(SNIPEFISH; TRUMPET-FISH; BELLOWS-FISH.)

Head 2½; depth 3½ to 4. D. V–12; A. 20; vertebræ 8 + 16. Body strongly compressed and somewhat elevated, covered with small striated scales, each stria terminating in a rather strong spine; second dorsal spine very strong, serrated posteriorly, its length about ⅙ total length of fish; snout several times longer than the rest of the head. Rose red or reddish olive above, silvery on the sides and belly. Mediterranean Sea; occasional northward to southern England; accidental on our North Atlantic Coast. (*scolopax*, snipe.) (Eu.)

*Balistes scolopax*, LINNÆUS, Syst. Nat., Ed. x, 1758, 329, Mediterranean.
*Silurus cornutus*, FORSKÅL, Descr. Anim., 66, 1775, Marseilles.
*Centriscus scolopax*, LINNÆUS, Syst. Nat., Ed. XII, I, 415, 1766; GÜNTHER, Cat., III, 518, 1861; JORDAN & GILBERT, Synopsis, 388, 1883.

## Order AA. LOPHOBRANCHII.

(THE LOPHOBRANCHS.)

Gills tufted, not laminated, composed of small rounded lobes attached to the gill arches. Interclavicles well developed. Scapula suspended to the cranium by a post-temporal. Superior branchihyals and pharyngeals, and basal branchihyals wanting or not ossified. Mouth very small, bounded above by the premaxillaries. Post-temporal simple, coossified with the cranium; basis of the cranium simple. Pectoral fins with elevated bases. Anterior vertebræ modified, the diapophyses much expanded. Air bladder simple, without air duct. Snout produced, bearing the small toothless mouth at the end. Gill covers reduced to a large simple plate. Skin with bony plates. Muscular system little developed.

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* The original type of *Centriscus*, Linnæus, and the only species placed by him in *Centriscus* in the tenth edition of the Systema Naturæ, is *Centriscus scutatus* L., a species of a different family. For the genus usually called *Amphisile*, the name *Centriscus* must therefore be used.

The family mentioned below has neither spinous dorsal, nor ventral fins; the *Solenostomatidæ* of the Indian Ocean, constituting the suborder *Solenostomi*, have all the fins well developed. (*Lophobranchii*, Günther, Cat., VIII, 150-206, 1870.) (*λόφος*, crest; *βράγχος*, gill.)

### Families of LOPHOBRANCHII.

SYNGNATHI:
- a. No spinous dorsal fin; no ventral fins; gill openings narrow. SYNGNATHIDÆ, CIII.

## Suborder SYNGNATHI.

This group is characterized among the *Lophobranchii* by the absence of spinous dorsal and ventral fins. It represents the extreme of degradation of the line of descent composed of the *Hemibranchii* and *Lophobranchii.*

### Family CIII. SYNGNATHIDÆ.

### (THE PIPEFISHES.)

Body elongate, usually slender, covered with bony plates which are firmly connected, forming a bony carapace. Head slender, the snout long, tube-like, bearing the short toothless jaws at the end. Gill openings reduced to a small aperture behind the upper part of the opercle. Tail long, prehensile or not, usually provided with a small caudal fin. Male fishes with an egg pouch, usually placed on the under side of the tail, sometimes on the abdomen, commonly formed of two folds of skin which meet on the median line. The eggs are received into this pouch and retained until some time after hatching, when the pouch opens, permitting the young to escape. Dorsal fin single, nearly median, of soft rays only; pectorals small, or wanting; ventrals none; anal fin minute, usually present. Genera about 15; species 150. Small fishes, found in all warm seas, sometimes entering fresh waters. (*Syngnathidæ*, Günther, Cat., VIII, 153–206, 1870.)

SYNGNATHINÆ:
- a. Tail not prehensile, usually with a caudal fin; axis of head usually in line with axis of body.
  - b. Humeral bones united.
    - c. Pectoral fins present; caudal present.
      - d. Male with the egg pouch under the tail, formed by lateral membranes which become connected along the middle, forming a closed pouch.
        - e. Dorsal fin inserted over or just before the vent; dorsal edges of trunk and tail continuous. SIPHOSTOMA, 344.
      - dd. Male with the egg pouch on the abdomen; ridges of the body prominent and distinct; caudal fin moderate. DORYRHAMPHUS, 345.
    - cc. Pectoral fins wanting; caudal wanting or rudimentary; male with the ova attached to the abdomen, without closed pouch; no adipose fin.
      - f. Back without peculiar tube. SYNGNATHUS, 346.
      - ff. Back with a peculiar tube inclosed by the scutes, and extending for a distance before the dorsal fin. OSPHYOLAX, 347.

HIPPOCAMPINÆ:

*aa*, Tail prehensile; caudal fin small; head shaped like that of a horse, placed at a large angle with axis of body; egg pouch at base of tail.

*g*. Body compressed; occiput with a narrow bony crest, surmounted by a coronet; shields with tubercles or spines. HIPPOCAMPUS, 348.

## 344. SIPHOSTOMA,* Rafinesque.

*Siphostoma*, RAFINESQUE, Caratteri Nuovi Generi, 18, 1810, (*pelagicus*).
*Syngnathus*, SWAINSON, Nat. Hist. Class'n. Anim., II, 1839, 332, (*acus*), and of writers generally; not of LINNÆUS, as first restricted by RAFINESQUE.
*Halicampus*, KAUP, Lophobranchii, 22, 1856, (*grayi*).
*Trachyrhamphus*, KAUP, Lophobr., 23, 1856, (*serratus*).
*Corythroichthys*, KAUP, Lophobr., 25, 1856, (*albirostris*).
*Dermatostethus*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 283, (*punctipinnis*).

Body elongate, very slender, 6 or 7 angled, not compressed, tapering into a very long tail; the dorsal keels of the trunk not continuous with those of the tail. Head slender, tapering into a long, tube-like, subterete snout, which bears the very short, toothless jaws at the end. Humeral bones firmly united with the "breast ring." Body covered with a series of bony, keeled, radiated plates, arranged in linear series. Dorsal fin distinct, rather short, inserted before or opposite the vent, which is near the middle of the body; caudal fin present, rather small; anal fin minute, close behind vent; pectorals developed, short and rather broad. Male fishes with an egg pouch along the under side of the tail, formed by two cutaneous folds, and splitting lengthwise to release the young fishes. Species very numerous, inhabiting all warm seas; abounding in bays among the seaweeds, and entering the rivers. The females in most species are deeper than the males, with more robust trunk, with longer snout, and a more distinct ventral keel. (*σίφων*, tube; *στόμα*, mouth.)

*a*. Top of head with a slight carination or none; snout keeled or not; opercle without prominent ridge; base of dorsal not elevated.

DERMATOSTETHUS (*δέρμα*, skin; *στῆθος*, breast):

*b*. Breast shields covered by soft skin; head not quite in a right line with axis of body; dorsal 41; rings 19 + 39; body robust; snout moderate; tail twice as long as trunk; head considerably keeled above. PUNCTIPINNE, 1110.

*bb*. Breast shields not covered with skin; head about in line with axis of body.

SIPHOSTOMA:

*c*. Dorsal moderate or long, its first ray in advance of vent; snout moderate or long; angles of body generally prominent.

*d*. Dorsal covering 1 or 2 body rings.

*e*. Dorsal covering 9 caudal rings.

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[*] The genus *Syngnathus* of Linnæus, originally equivalent to the modern family of *Syngnathidæ*, was first subdivided by Rafinesque in 1810. The name *Siphostoma* was given to *S. pelagicus* and its relatives, the *Syngnathus* of late writers, that of *Tiphle* to *S. typhle*, the *Siphonostoma* of late writers, while *Syngnathus* was retained for *S. æquoreus* and its relatives, the group now usually called *Nerophis*, the type of *Nerophis* being *Syngnathus ophidion*, L. This arrangement has been adopted here, but it is open to two objections besides the fact that it is contrary to the general usage, which makes *acus* the type of *Syngnathus*, in accordanace with Swainson's arrangement. These objections are, (1) that Artedi, from whom Linnæus accepted the genus *Syngnathus*, did not know of the existence of *Syngnathus æquoreus*, and (2) the statement of Linnæus (which we have been unable to verifiy), that the type of each of his genera is the "best known European or officinal species." *Syngnathus acus* would meet this requirement, but not *Syngnathus æquoreus*, which had not then been found in Europe. Should these objections be found valid, *Syngnathus* would take the place of *Siphostoma*, and *Nerophis* that of *Syngnathus*.

*f.* Back transversely concave, the sides of the body also concave; the angles very sharp; dorsal rays 40 to 44, the fin on 1 + 8½ rings; rings about 17 + 41; snout strongly keeled. CARINATUM, 1111.

*ff.* Back transversely convex, the lateral faces of body flat or convex, the angles blunt.

*g.* Rings 20 to 21 + 45 or 49; top of head not keeled; snout long; size large; dorsal rays 39 to 46 on 1 + 9 rings. CALIFORNIENSE, 1112.

*gg.* Rings 18 or 19 + 39 to 42; snout shorter, slightly keeled; dorsal 36 to 41, on 1 + 9 rings. GRISEOLINEATUM, 1113.

*ee.* Dorsal covering about 6 or 7 caudal rings, rarely fewer.

*h.* Body rings 16 to 20.

*i.* Caudal rings 36 to 41.

*j.* Dorsal rays 30 to 32; snout 2 or less in head; head somewhat keeled in young. LEPTORHYNCHUM, 1114.

*jj.* Dorsal rays 37, on 1 + 7 rings; rings 20 + 41; snout moderate, 1½ in head. FISTULATUM, 1115.

*ii.* Caudal rings 31 to 34.

*k.* Dorsal rays 34; rings 18 + 31; snout short; body stout; tail short. BARBARÆ, 1116.

*kk.* Dorsal rays 27 to 31.

*l.* Snout moderate, 1⅔ to 2 in head; dorsal on 2 + 6 rings. MACKAYI, 1117.

*ll.* Snout long, 1⅓ in head; dorsal on 1 + 7 rays, rarely on 2 + 6. FLORIDÆ, 1118.

*iii.* Caudal rings 24; body rings 19; dorsal rays 30, on 1 + 6 rings; snout long; body slender. POEYI, 1119.

*hh.* Body rings 15; caudal rings 38; dorsal rays 29 to 30; top of head distinctly keeled; snout short. AULISCUS, 1120.

*eee.* Dorsal covering 4 or 5 body rings.

*m.* Dorsal rays 24 to 32.

*n.* Dorsal rays 29 to 32, on 1 + 9 rings; rings 17 + 35; snout 2 in head; head with keel. PELAGICUM, 1121.

*nn.* Dorsal rays 26 to 28, on 1½ + 5 rings; rings 16 to 34; snout short, 2 in head; head with slight keel. ROUSSEAU, 1122.

*nnn.* Dorsal rays 24 or 25, on about 1 + 4 rings; rings usually 16 + 33; snout short, 2 in head. ELUCENS,* 1123.

*mm.* Dorsal very short, 18 rays, on 1 + 5 rings; rings 17 + 32; snout short. JONESI, 1124.

*eeee.* Dorsal very short, covering 3 caudal rings, and 1½ body rings; its rays 20 to 23; rings 17 + 27; snout very short; head keeled above. BRACHYCEPHALUM, 1125.

*dd.* Dorsal covering 3 body and 4 to 6 caudal rings.

*o.* Rings 16 or 17 + 29 to 32.

*p.* Snout rather short, not half length of head; dorsal fin very high; rings 18 + 33; dorsal 35, on 5 + 4 rings; belly in female with a black keel; sides with narrow vertical silvery streaks; dorsal spotted. AFFINE, 1126.

*pp.* Snout rather long, more than half head.

*q.* Rings 18 + 31 to 34; dorsal 30 to 34, on 3 + 5 rings. SCOVELLI, 1127.

*qq.* Rings 17 + 31; dorsal rays 30, on 3 + 6 rings; head little keeled above. BAIRDIANUM, 1128.

*oo.* Rings 20 to 21 + 36 to 38; dorsal 32 to 37, on 3 + 5 rings; belly flat or slightly concave; snout moderate. LOUISIANÆ, 1129.

*ooo.* Rings 16 to 20 + 36 to 40; dorsal 36 to 40, on 5 + 4 or 4 + 5 rings. FUSCUM, 1130.

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* Including *flavirostre*, *picturatum*, *linea*, *marmoreum*, and *ascendens*.

*cc.* Dorsal fin large, of 38 rays, the first ray not in advance of vent; rings 14 + 37. STARKSI, 1131.

*ccc.* Dorsal fin very short, its first ray not in advance of vent; rings 15 + 37 to 39; snout very short, less than $\frac{2}{5}$ head; angles of body little marked, the form subterete.

  *r.* Dorsal rays 20; rings 15 + 39; snout $2\frac{1}{3}$ in head. ARCTUM, 1132.

  *rr.* Dorsal rays 20; rings 15 + 38 or 39; snout 3 in head; body with dark cross bands and pale spots. CRINIGERUM, 1133.

CORYTHROICHTHYS (κορύθρος, crown; ἰχθύς, fish):

*aa.* Top of head strongly carinated, keel usually extending from interorbital space to first body ring; body stout, usually with sharp angles and variegated coloration; head in line with axis of body; opercle with a prominent ridge.

  *s.* Caudal rings about 30; dorsal rays 23 to 27, snout short.

    *t.* Rings 18 + 30; dorsal rays 23, on 1 + 4 rings; snout $2\frac{2}{5}$ in head, itc color white; body with 12 irregular brown cross bands, and white markings. ALBIROSTRE, 1134.

  *ss.* Caudal rings 25, body rings 20; dorsal rays 40, on 3 + 7 rings; snout long, more than half head; form of body undescribed. CAYENNENSE, 1135.

### Subgenus DERMATOSTETHUS, Gill.

### 1110. SIPHOSTOMA PUNCTIPINNE (Gill).

Head 8. D. 41; rings 19 + 39. Eye large. Body comparatively robust. Snout moderate, a little longer than the rest of the head. Occiput with a raised keel; joint between the occiput and the first dorsal shield more perfect than usual, so that the head can be placed at an angle with the body. Greatest depth about equal to length of postorbital part of head. Skin on breast and anterior ventral plates thin, showing the striation of the bones. Tail twice as long as trunk. Brown; dorsal fin speckled. Length 12 inches. San Diego, known only from the original types, which possibly are not distinct from *S. griseolineatum.* (*punctus*, dotted; *pinna*, fin.)

*Dermatostethus punctipinnis*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 283, San Diego, California.
*Siphostoma punctipinne*, SWAIN, Proc. U. S. Nat. Mus., 1882, 308; JORDAN & GILBERT, Synopsis, 385, 1883.

### Subgenus SIPHOSTOMA.

### 1111. SIPHOSTOMA CARINATUM, Gilbert.

Rings 17 or 18 + 40 to 42. D. usually 43 or 44 (39 to 44) on 1 + $8\frac{1}{2}$ rings. Snout very slender, compressed, its length $1\frac{1}{3}$ to $1\frac{1}{2}$ times rest of head. Eye $2\frac{1}{10}$ in postorbital part of head. Head and trunk contained $1\frac{1}{2}$ to $1\frac{3}{5}$ in tail. Trunk $2\frac{1}{3}$ in tail. Closely related to *Siphostoma californiense* and *griseolineatum*, differing in the very slender, sharply keeled snout, in the height and sharpness of the body ridges, the upper and lateral faces being all concave, and in the coloration. No ridge on opercle. Breast and belly with a low median keel. Snout sharply keeled, the ridge ceasing on interorbital space to reappear on occiput and first nuchal plate. Lateral ridge interrupted immediately above the vent. Base of dorsal equaling length of head, covering $9\frac{1}{2}$ rings, only the first of which is in front of the vent; pectorals short, $\frac{1}{3}$ length of snout; caudal pouch on 22 anal plates. Keels on body sharp and high, and the interspaces are transversely concave. Color light olive or grayish, the back and upper part of sides mottled with brown, this frequently taking the form of rather wide, ill-defined bars; interspace between bars often marked with a narrow, pearly-white crossbar; on lower portion of sides of tail, a brown streak between each two plates; dorsal light, its basal portion with oblique brown streaks and spots; central portion of caudal dusky, the fin broadly margined all around with white. Many specimens, males and females, from Albatross Stations 3027 and 3028, in the Gulf of California; the largest 8½ inches long. (*carinatus*, keeled.)

*Siphostoma carinatum*, GILBERT, Proc. U. S. Nat. Mus., 1891, 547, Gulf of California, 31° 31′ N., 114° 19′ W. (Coll. Albatross.)

### 1112. SIPHOSTOMA CALIFORNIENSE (Storer).

(GREAT PIPEFISH.)

Head 6⅙ to 8½ in total length; D. 39 to 46; rings 20 to 21 + 47 to 49. Trunk robust. Snout very long, 1½ to 1⅘ in head, with median ridge above and below. Occiput and nuchal plates not carinated in adults. Dorsal shorter than head, covering 1 + 9 rings; distance to dorsal 2¾ in length; pectorals as long as high, equaling in length the diameter of eye; caudal pouch of males covering 21 to 25 rings, its length 3 in total. Color in life olivaceous, varying to brownish red; yellowish below; head and body variously marbled and speckled with whitish, the marking posteriorly taking the form of short horizontal grayish streaks, especially distinct on the top of the head; anteriorly often forming narrow bars. Snout variable, sometimes not longer than head. Pacific Coast of the United States from Santa Barbara northward; common south of San Francisco. Much larger than the other American species, reaching a length of 18 inches. Described here from specimens taken at Santa Barbara and Monterey.

*Syngnathus californiensis*, STORER, Proc. Bost. Soc. Nat. Hist., II, 1845, 73, California.

*Siphostoma californiense*, SWAIN, Proc. U. S. Nat. Mus., 1882, 309; JORDAN & GILBERT, Synopsis, 384, 1883.

### 1113. SIPHOSTOMA GRISEOLINEATUM (Ayres).

D. 36 to 41; rings 18 to 19 + 39 to 42. Closely allied to *S. californiense*, but differing in a somewhat shorter snout, in the number of dorsal rays, in the number of rings, in its size, in the snout being slightly more keeled, and in the dorsal covering 0–1 + 9 rings. Pacific Coast of the United States, from Puget Sound to Monterey, rather less common than the preceding species, and somewhat smaller in size. (*griseus*, gray; *lineatus*, lined.)

*Syngnathus griseolineatus*, AYRES, Proc. Cal. Ac. Sci., 1854, 14, San Francisco Bay.

*Syngnathus abboti*, GIRARD, Pac. R. R. Survey, Fishes, X, 346, 1858, San Francisco.

*Siphostoma griseolineatum*, SWAIN, Proc. U. S. Nat. Mus., 1882, 310; JORDAN & GILBERT, Synopsis, 905, 1883.

### 1114. SIPHOSTOMA LEPTORHYNCHUM (Girard).

Head 6¼ to 8¼ in total length. D. 30 to 32; rings 17 to 19 + 36 to 41. Snout 1⅗ to 2 in head; median line of snout above carinate; occiput and nuchal plates weakly keeled in young, the keels apparently disappearing in adults. Angle of belly less acute than in *S. californiense*; the keel sometimes wanting. Dorsal fin shorter than head, covering 1 + 7 rings; caudal pouch covering about 19 rings. Otherwise essentially as in *S. californiense*. Length 6 inches. San Francisco to San Diego, generally common along the sandy shores. (*λεπτός*, slender; *ῥύγχος*, snout.)

*Syngnathus brevirostris*, Girard, Proc. Ac. Nat. Sci. Phila., 1854, 156, San Diego; name preoccupied.

*Syngnathus arundinaceus*, Girard, Pac. R. R. Survey, Fishes, x, 346, 1858, Coast of California; specimens with nuchal plates keeled.

*Syngnathus dimidiatus*, Gill, Proc. Ac. Nat. Sci. Phila., 1862, 284, San Diego; substitute for *brevirostris*, preoccupied; specimens with short snout, scarcely longer than rest of head.

*Syngnathus leptorhynchus*, Girard, Proc. Ac. Nat. Sci. Phila., 1854, 156, San Diego.

*Siphostoma leptorhynchus*, Jordan & Gilbert, Synopsis, 384, 1883; Swain, Proc. U. S. Nat. Mus. 1882, 311.

### 1115. SIPHOSTOMA FISTULATUM (Peters).

Rings 20 + 41. Dorsal 37, on 1 + 7 rings. Snout twice as long as the distance of the posterior end of opercle from the orbit, and but little higher than broad. Supraorbital ridges continued on the crown and convergent. Opercle with a keel on its anterior half, and with radiating striæ. The entire head leathery, rough. Shields without spines. Lateral line passing into the upper caudal edge. Tail twice as long as the trunk (without head). Pouch on 21 caudal rings. (Peters.) Puerto Cabello; not seen by us. (*fistula*, a tube.)

*Syngnathus fistulatus*, Peters, Monatsber. Ak. Wiss. Berk., 456, 1868, Puerto Cabello.

*Siphostoma fistulatum*, Günther, Cat., viii, 161, 1870.

### 1116. SIPHOSTOMA BARBARÆ, Swain.

Rings 18 + 31. Dorsal rays 34, the fin inserted on 1 + 7 rings. Ten rings on the tail behind the caudal pouch. Head 7⅔ in length; base of dorsal equal to head. Distance from snout to dorsal 2⅓ in length; caudal pouch 2⅗ in length of body; tail behind caudal pouch 6 times. Body unusually stout, with short head, short snout, and short tail, the general appearance being much like *S. californiense*, but all the parts contracted. Snout short, compressed, just as long as the rest of the head (male), its upper edge with a sharp, low keel, which is higher than in *S. californiense*. Top of head without keel. Opercle striate, with trace of a keel at base. Keels of body not very sharp, the interspaces between the angles scarcely concave; lateral line not continuous with the upper edge of the tail; belly with a slight median keel. Dorsal fin low. Color blackish, with fine pale vermiculations; top of head and neck with wavy longitudinal streaks; caudal dusky; dorsal somewhat mottled; a dusky blotch before eye. Santa Barbara; one specimen known. (*barbaræ*, from Santa Barbara, the type locality.)

*Siphostoma barbaræ*, Swain, Proc. U. S. Nat. Mus., 1884, 238, Santa Barbara. (Type, No. 31253. Coll. Andrea Larco.)

*Siphostoma bairdianum*, Swain, Proc. U. S. Nat. Mus., 1882, 311; not of Duméril; Jordan & Gilbert, Synopsis, 905, 1883.

### 1117. SIPHOSTOMA MACKAYI, Swain & Meek.

Head 5⅔ to 6¼ in total length. D. 29 to 32; rings 18 + 33 to 36. Snout rather long, compressed, 1¾ to 2 in head, its median line with a slight keel above and below, with smaller keels on each side; opercle not keeled. Dorsal somewhat higher than width of a body ring, its base about 1⅓ in length of head, covering 2 + 6 rings. Pectoral higher than length of base; tail about 1⅚ in total length of fish; body deep; its greatest depth in adult females equals width of 4 body rings. Color in spirits grayish or dark olive; the males with about 14 dark-gray crossbars on the sides, broader than the interspaces; the body is usually more or less spotted with small white spots; dorsals pale, usually dotted over with darker; caudal dusky, generally spotted with white; opercle usually with white bars. Gulf of Mexico, known from the Snapper Banks off Pensacola, Key West, and Cozumel, Yucatan; rather common. (Named for Charles Leslie McKay, of Appleton, Wisconsin, an accomplished young naturalist, who was drowned in Bristol Bay, Alaska, while on a collecting expedition in 1884.)

*Siphostoma mackayi*, SWAIN & MEEK, Proc. U. S. Nat. Mus., 1884, 239, Key West; BEAN, Bull. U. S. Fish Comm., VIII, 1888, 195; D. 30 on 2 + 5 rings; rings 17 + 35, opercle not keeled; snout 1⅔ in head; JORDAN, Proc. U. S. Nat. Mus., 1886, 225; D. 32, on 2½ + 5½ rings; rings 18 + 36. No pale spots; crossbars well marked.

### 1118. SIPHOSTOMA FLORIDÆ, Jordan & Gilbert.

Head 6 to 6½ in total length. D. 27; rings 17 to 18 + 31 to 32. Snout rather short, about 1⅔ in head; median line well keeled above and below, the ridge on both sides of median ridges above and below not so conspicuous. Occiput and opercle little keeled. Dorsal shorter than head, covering 1 + 6 to 7 rings, its height 5 times in its base; caudal fin 2½ in base of dorsal; pectoral slightly higher than length of its base; tail longer than trunk, 1⅚ in total length, caudal pouch covering about 18 rings. Color in life dark green; sides with gray specks and without dark band; tail with faint darker bars, broader than the interspaces. Sides of tail, especially mesially, with many rough and oblong pale spots. Snout mottled, especially on side. Lower part of opercle nearly plain. Dorsal translucent, yellowish at base. Caudal yellow, dusky at tip. Anal plain. Sandy shores from North Carolina to Texas (Beaufort, North Carolina; Corpus Christi, Texas); rather common. (*floridæ*, Florida.)

*Siphostoma floridæ*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 263, Pensacola, Florida. (Type, No. 30826. Coll. Jordan.) SWAIN, Proc. U. S. Nat. Mus., 1882, 312; JORDAN & GILBERT, Synopsis, 905, 1883.

### 1119. SIPHOSTOMA POEYI, Jordan & Evermann, new specific name.

D. 30, on 1 + 6 segments; rings 19 + 24. Snout long. Occipital crest very low. Body and tail banded, color gray with pale markings. One specimen known, from Havana; not seen by us. (Named for its describer, Felipe Poey, Professor of Zoölogy in the University of Havana; the most eminent naturalist of Spanish-speaking countries.)

*Syngnathus tenuis*, POEY, Synopsis, 444, 1867, Havana; name preoccupied.

### 1120. SIPHOSTOMA AULISCUS, Swain.

Head 9 to 9¼ in total length. D. 29 to 30; rings 15 + 37 to 38. Trunk rather slender. Snout 2 in head, median ridge above distinct, below comparatively broad and blunt. Occiput and nuchal plates sharply carinated; belly weakly keeled. Opercle slightly keeled, very convex, making the head slightly broader than deep. Dorsal little longer than head, covering 1 + 7 rings; pectorals scarcely higher than long, slightly exceeding diameter of eye. Tail longer than rest of body, 1⅗ in total length; caudal pouch covering 21 rings. Color in spirits somewhat lighter than *S. californiense*, scarcely mottled or marbled. Southern California, north to Point Concepcion; not very common. (diminutive of *αὐλός*, a tube.)

*Siphostoma auliscus*, SWAIN, Proc. U. S. Nat. Mus., 1882, 310, Santa Barbara; San Diego; JORDAN & GILBERT, Synopsis, 905, 1883.

### 1121. SIPHOSTOMA PELAGICUM (Osbeck).

Rings 17 + 35. Dorsal 29 to 32, commencing somewhat in advance of vent, on 1 + 9 rings. Snout 2 in distance to base of pectoral. A distinct ridge along the median line of the nuchal shields; supraorbital ridge not continued over the temple; anterior part of the operculum with a faint ridge; shields without spines; lateral line interrupted. Tail longer than body; caudal pouch short, about 3 in total length. Color brown, nearly plain, or with lower half of side of abdomen with vertical silver bars, becoming broader and of a whitish color on the upper half; brown cross bands occuring alternately between the silver bars, so that the brown bands are grouped together in twos or threes, the bands of each group more or less confluent; in males the silvery bands are represented by spots; a brown band through the eye and along the snout; dorsal fin with oblique brown bands. Tropical parts of the Atlantic; occasional in the West Indies; very common in the Mediterranean; our specimens from Venice. (*pelagicus*, living in the open sea.) (Eu.)

*Syngnathus pelagicus*, OSBECK, Dagbök Resa Ostindien, 305, 1757, open sea in floating seaweed; LINNÆUS, Syst. Nat., Ed. x, 1758, 337, after OSBECK; GÜNTHER, Cat., VIII, 165, 1870.

*Syngnathus ethon*, RISSO, Eur. Mérid., III, 1826, Nice.

### 1122. SIPHOSTOMA ROUSSEAU (Kaup).

Head 7⅕; D. 26 to 28, on 1½ + 5 rings; rings 16 + 34 = 50. A small, slender species, with the snout ¼ longer than the rest of the head; top of head with a slight keel; vent midway between tip of snout and twenty-third caudal segment. Head almost 3 times in distance from tip of snout to vent. Lateral line interrupted above the vent. Color plain. West Indies, known from St. Lucia and Martinique; also from Cuba, if *S. elucens* is the same, as is not unlikely. (Named for Alexandre Rousseau of Martinique.)

*Syngnathus rousseau*, KAUP, Lophobranchii, 40, 1856, Martinique; GÜNTHER, Cat. VIII, 163, 1870.

*Siphostoma rousseau*, JORDAN, Proc. U. S. Nat. Mus., 1889, 647.

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### 1123. SIPHOSTOMA ELUCENS (Poey).

Very close to *S. pelagicum*, but with 24 or 25 dorsal rays. Head 7½ in total length. Snout 2 in head. Rings 16 or 17 + 33 or 34. Dorsal 24 or 25, on 2 + 4, sometimes on 1½ + 4½ rings. Grayish brown, a silvery bar on each ring; dorsal with black streaks. (Poey.) Cuba; not rare; probably identical with *S. rousseau*; both species closely related to *S. pelagicum*. (*elucens*, shining out.)

*Syngnathus elucens*, Poey, Synopsis, 443, 1867, Havana.
*Syngnathus flavirostris*,[*] Poey, Eumeratio, 178, 1875, Havana.
*Syngnathus picturatus*,[†] Poey, Eumeratio, 178, 1875, Havana.
*Syngnathus linea*,[‡] Poey, Eumeratio, 178, 1875, Havana.
*Syngnathus marmoreus*,[§] Poey, Eumeratio, 178, 1875, Havana.
*Syngnathus ascendens*,[‖] Poey, Eumeratio, 179, 1875, Havana.

### 1124. SIPHOSTOMA JONESI (Günther).

Rings 17 + 32. Dorsal 18, on 1 + 5 rings. Head and snout short, the latter somewhat bent upward, shorter than the postorbital portion of head, keeled above, but without spines in the median line. Interorbital space concave, crown and occiput with a median keel. Keels of body sharp, but not spiny; the lateral keel of the trunk passes into the lower keel of the tail; a ridge runs across the opercle but does not reach its end; tail twice as long as the trunk without head; caudal very short. Blackish brown; upper half of trunk with three, upper half of tail with seven equidistant white cross bands. (Günther.) Bermuda Islands. (Named for John Matthew Jones, an English naturalist, resident at Bermuda.)

*Syngnathus jonesi*, Günther, Ann. and Mag. Nat. Hist., Series 4, xiv, 8, 1874, Bermudas.

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[*] *Siphostoma flavirostre* (Poey):

Dorsal 25, on 1½ + 4½ rings; rings 17 + 33. Head 8 in total length, snout nearly as long as rest of head; lateral line interrupted. Head yellowish, without black specks. Dorsal with bands; a silver streak along lower part of side. One specimen, from Havana. (Poey.)

[†] *Siphostoma picturatum* (Poey):

Head 7½ in total length, half as long as trunk. Snout nearly as long as rest of head. Nasal crest evident. Opercle sculptured like a mussel shell. Black, with a shining vertical band on each ring. Snout with alternate bands of black and green. Dorsal with black streaks. One individual, from Havana. (Poey.)

[‡] *Siphostoma linea* (Poey):

Rings 16 + 33. Head 7¼ total. D. 25. Body very slender, depth 3½ in head. Snout as long as rest of head. Dorsal on 1½ + 4½ rings. Yellowish brown, with paler markings. Head with light and dark spots. Dorsal with oblique lines. Two specimens from Havana. (Poey.)

[§] *Siphostoma marmoreum* (Poey):

Rings 16 + 33. D. 24, on ½ + 4 rings. Head 7½ in total, depth 3 in head. Snout very slightly shorter than rest of head. No postorbital crest. Color ashy, with two pale spots on middle of each segment. Dorsal unmarked. Snout marked with white and ashy. Havana. (Poey.)

[‖] *Siphostoma ascendens* (Poey):

Rings 16 + 33. D. on 1½ + 4 rings. Head 7 in total length. Lateral line not interrupted. Snout as long as rest of head. No postorbital crest. Brownish yellow; faint vertical streak on each ring, most distinctly anteriorly. Snout with pale bands. One specimen from Havana. (Poey.)

### 1125. SIPHOSTOMA BRACHYCEPHALUM (Poey).

Rings 17 + 27. D. 20 to 23, on 1½ + 3 rings. Head deep; depth of body 1½ in head. Snout very short, as long as distance between front of eye and base of pectoral; occipital crest well marked. Brown, with ashy marks, a white band along side of body. Cuba. (Poey); not seen by us. (*βραχύς*, short; *κεφαλή*, head.)

*Syngnathus brachycephalus*, Poey, Synopsis, 444, 1867, Havana.

### 1126. SIPHOSTOMA AFFINE (Günther).

Head about 9 in total length; snout a little more than 2 in head. Rings 18 + 33. Dorsal 35, on 5 + 4 rings. A distinct ridge along median line of snout and nuchal shields; supraorbital ridge continued over the temple; a faint ridge on front of opercle; shields without spines. Tail longer than body; caudal pouch half length of body; lateral line interrupted. Vent below posterior third of dorsal fin; caudal fin well developed; anal fin rudimentary. Back with indistinct brown crossbars; a brown band from eye along snout. Gulf of Mexico; Louisiana. (Günther.) Most of recent Gulf of Mexico references to this species were apparently based on specimens of *S. scovelli*, which has been confounded with it. (*affinis*, related.)

*Syngnathus affinis*, Günther, Cat., VIII, 163, 1870, Louisiana.

### 1127. SIPHOSTOMA SCOVELLI, Evermann & Kendall.

Allied to *Siphostoma affine*. Head 7 to 7½; depth 14 in female and 22½ in male; eye 6½ to 7; snout 2¼. D. 30 to 34, on 4 + 4 rings, its height 2 to 3⅕ in its base, which equals head. Rings 16 + 30 to 33, usually 16 + 32. Top of head with a slight keel. Body rather slender (deeper in females); snout short; ventral surface slightly convex in front of vent, slightly concave behind. Color of female in alcohol, alternately annulated with light olive-brown and dirty white, the dark color on the joints, the white on bodies of rings; the dark rings wider than the white on trunk, but narrower on caudal portion, the white rings of trunk indicated between lateral and latero-ventral keels by 2 narrow white lines with narrow black lines on either side and between; these portions of the whitish rings show as silver bars in life; upper part of opercle dusky; a dark bar from anterior edge of eye to tip of snout; ventral keel, throat, lower part of opercle, and snout plain whitish; dorsal with dark wavy diagonal bars; the variations in color are considerable; in some females there are no distinct white or silvery bars; some are darker and some still lighter; the males resemble the lighter females. Length 4½ inches. Common at Corpus Christi and perhaps elsewhere on the coast of the Gulf of Mexico. Apparently most of the published references to *S. affine* from the Gulf of Mexico belong to this species, which differs from *S. affine* chiefly in having fewer body rings, in the more posterior position of the dorsal fin, and in the fewer dorsal rays. (Named for Dr. Josiah T. Scovell of Terre Haute, Indiana.)

*Siphostoma fuscum*, var., Evermann & Kendall, Bull. U. S. Fish Comm., xii, 1892 (1894), 109.

*Siphostoma scovelli*, Evermann & Kendall, Proc. U. S. Nat. Mus., xviii, 1895, 109, Shamrock Point, Corpus Christi, Texas. (Type, No. 47300. Coll. Evermann, Scovell, and Gurley.)

*Siphostoma affine*, Jordan & Gilbert, Synopsis, 383, 1883, part; Swain, Proc. U. S. Nat. Mus., 1882 (1883), 313.

### 1128. SIPHOSTOMA BAIRDIANUM (Duméril).

Rings 17 + 31. Dorsal 30, on 3 + 6 rings. Head nearly 7 in total length; snout more than ⅓ longer than postocular part of head. Median crest feebly marked; opercular crest very short. Yellowish, all the rings with a brown streak. (Duméril.) Coast of Mexico, near California; known from Duméril's description, which has been verified for us on the original type. (Named for Spencer Fullerton Baird.)

*Syngnathus bairdianus*, Duméril, Hist. Nat. Poiss., ii, 574, 1870, Coast of Mexico, near California.

### 1129. SIPHOSTOMA LOUISIANÆ (Günther).

Head 7 to 7⅗ in total length. D. 32 to 37; rings 20 to 21 + 36 to 38. Trunk broader below. Snout moderate, about 1⅗ in head; median ridge above and below, a ridge on each side of median ridge above and below. Occiput, nuchal plates, and opercle somewhat keeled. Belly flat or slightly concave, with a median ridge. Dorsal fin well developed, shorter than head, covering 3 + 5 rings. Caudal longer than pectoral, 2½ in base of dorsal. Tail longer than trunk, 1$\frac{7}{9}$ in total length. Color brownish, lighter on lower part of trunk and below; sides with a distinct band of brown; brown of the side extending through eye to middle of snout. Atlantic and Gulf coasts of the United States, North Carolina to Texas, south to Key West; common and variable.

*Syngnathus pelagicus*, var., Linnæus, Syst. Nat., Ed. xii, 416, 1766; Charleston, South Carolina.

*Syngnathus louisianæ*, Günther, Cat., viii, 160, 1870, New Orleans; Swain, Proc. U. S. Nat. Mus., 1882, 313; Jordan & Gilbert, Synopsis, 383, 1883.

### 1130. SIPHOSTOMA FUSCUM (Storer).

(Common Pipefish.)

Head 7½ to 9 in total length. D. 36 to 40; rings 18 to 20 + 36 to 40. Snout short, about 2 in head; median line above and below well keeled, the ridge on each side of median ridges rather conspicuous. Occiput, nuchal plates, and opercle carinate; belly somewhat convex, scarcely keeled. Dorsal longer than head, covering 4–5 + 5–4 rings, its height 5–6 in length of its base; tail much longer than trunk, 1⅔ in total length. Color in spirits olivaceous or brownish; lighter below, especially on belly, lower half of opercles, and snout; sides mottled and blotched much as in other species. Atlantic Coast of the United States, Cape Ann to Virginia; very common northward, where it is the only species of pipefish. (*fuscus*, dusky.)

*Syngnathus peckii*, Storer, Report Fishes Mass., 3, 1839, (name only).

*Syngnathus fuscus*, Storer, Report Fish. Mass., 162, 1839, Nahant.

*Syngnathus peckianus*, STORER, Report Fish. Mass., 163, pl. I, fig. 2, 1839, Holmes Hole, Marthas Vineyard.

*Syngnathus fasciatus*, DE KAY, New York Fauna: Fishes, 319, pl. 54, fig. 174, 1842, New York.

*Syngnathus viridescens*, DE KAY, *l. c.*, 321, pl. 54, fig. 176, 1842, New York.

*Syngnathus dekayi*, DUMÉRIL, Hist. Nat. Poiss., II, 569, 1870, New York.

*Syngnathus milbertianus*, DUMÉRIL, *l. c.*, 573, New York.

*Siphostoma fuscum*, SWAIN, Proc. U. S. Nat. Mus., 1882, 314; JORDAN & GILBERT, Synopsis, 382, 1883.

### 1131. SIPHOSTOMA STARKSI, Jordan & Culver.

Head 10½; depth 21. D. 38, on 0 + 10 or 11 rings. Rings 14 + 37 or 38 = 51 or 52. Tail twice length of head and trunk. Snout 2⅓ in head. Dorsal half longer than head. Body rather stout; head scarcely carinate above; snout very short with a slight smooth keel; no keel on opercle; belly slightly keeled; 2 lateral keels on body confluent into 1 behind. Color dark olive, much mottled with darker, but without distinct markings; belly yellowish. Length 4 to 6 inches. Close to *S. arctum*, but differing in the much larger dorsal and the greater number of rings covered by it. Rio Presidio, Sinaloa, abundant among *Algæ* in clear fresh water, near the town of Presidio, 9 miles above tide water. Apparently breeding in fresh water, as the sac of the male is full of eggs. (Named for Edwin Chapin Starks, preparator in Leland Stanford Junior University.)

*Siphostoma starksi*, JORDAN & CULVER, Fishes of Sinaloa, MS., 1895, Rio Presidio, Mazatlan. (Type, No. 47425. Coll. Hopkins Expedition.)

### 1132. SIPHOSTOMA ARCTUM, Jenkins & Evermann.

Head 9 to 11 in body to base of caudal; depth 20; dorsal 20, on about 0 + 5 rings; rings 15 + 39. Top of head scarcely carinated, the opercle without a prominent ridge. Snout 2⅓ in head, keeled in the median line. Dorsal slightly higher than the width of a body ring, its length about equaling the head; pectoral 3 in head; distance from tip of snout to vent ½ to ⅝ length of tail; caudal about 3 in head. Color pale, with no evident markings except on the under side of the tube of the snout, and as far back as the posterior margin of the eye, where there are dark mottlings. Mazatlan specimens show narrow white cross bands about 4 rings apart. Gulf of California, south to Mazatlan, one specimen taken at Guaymas, and two others recently taken at Mazatlan by the Hopkins Expedition; a small and slender species. (*arctus*, contracted.)

*Siphostoma arctum*, JENKINS & EVERMANN, Proc. U. S. Nat. Mus., 1888, 137, Bay of Guaymas. (Type, No. 39639. Coll. Jenkins & Evermann.)

### 1133. SIPHOSTOMA CRINIGERUM, Bean & Dresel.

Rings 15 + 38 or 39. Dorsal rays 16 or 17, on 0 + 4 rings. Snout very short, less than ½ length of head, rounded above; slightly keeled; angles of body little marked; head nearly 11 times in total length to caudal base; eye 5 in head; depth of body half length of head. Caudal pouch 4 times in length of body, 17 caudal rings; pectoral and caudal very small. Color chestnut brown, with about 12 broad dark-brown cross bands on back, middle of each cross band with many pale-blue streaks, the most distinct downward and backward from eye. West Indies, from Pensacola and Key West to Abrolhos Reef, Brazil; rather common southward about rocks and coral reefs. One of the smallest species, length 3 inches. (*criniger*, bearing hair.)

*Siphostoma crinigerum*, BEAN & DRESEL, Proc. Biol. Soc. Wash., II, 99, 1884, Pensacola; SWAIN & MEEK, Proc. U. S. Nat. Mus., 1884, 239.

### Subgenus CORYTHROICHTHYS, Kaup.

### 1134. SIPHOSTOMA ALBIROSTRE* (Heckel).

Head 9 in total length. D. 23; rings 18 + 30. Body robust. Snout short, 2⅗ in head; a strong median ridge above on snout, 2 ridges below with a median groove, and on each side of the groove is a horizontal ridge running to lower part of orbit. Occiput and nuchal plates very sharply carinated; opercle with 2 horizontal ridges. Belly somewhat concave, little keeled. Dorsal much shorter than head, covering 1 + 4 rings; caudal well developed, 1⅖ in base of dorsal; tail longer than rest of body, 1⅘ in total length. Color in spirits light olivaceous, with about 12 irregular brown cross bands, each covering from 2 to 3 rings; snout light, with 2 or 3 narrow cross bands below; rest of head dusky. West Indies, north to Pensacola and Key West, south to Bahia; a singular and handsome species, quite unlike the others and found in deeper waters, and especially about coral reefs, not on sandy shores. (*albus*, white; *rostrum*, snout.)

*Corythroichthys albirostris*, HECKEL, MS., Kaup, Lophobranchii, 25, 1856, Mexico; Bahia; description incorrect.

*Siphostoma zatropis*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 264, Snapper Banks, Pensacola; SWAIN, *l. c.*, 308; JORDAN & GILBERT, Synopsis, 906, 1883.

*Syngnathus albirostris*, GÜNTHER, Cat., VIII, 170, 1870.

### 1135. SIPHOSTOMA CAYENNENSE (Sauvage).

Head 5. D. 40; P. 18; C. 8. Rings 20 + 25. Dorsal on 3 + 7 rings. Snout twice length of postocular part of head, 4 times diameter of eye, much longer than dorsal. Occipital crest well marked as well as the crest at the shoulder; snout with a well-marked median carina. Brown, edge of each ring blackish; 2 silvery streaks along flanks, very narrow, and composed of small spots placed end to end. Length 5 inches. Cayenne.

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* Kaup gives the rings in *albirostris* as 12 + 29. On account of this difference we had formerly regarded our specimens as types of a distinct species, *Siphostoma zatropis*. The following is the substance of Kaup's description:

*Corythroichthys albirostris*, HECKEL, MS.:

P. 12; D. 27; A. 2 or 3; C. 10. Rostral crest median and interrupted. Body rings 12 (misprint for 19), tail rings 29; dorsal fin standing on 5 rings, 4 of which belong to the tail. Snout half the length of the distance between the fore border of the orbit and the base of the pectoral fin. Color yellowish brown, with 14 blackish crossbars. Lower part of the gill cover brown with blue stripes. Length of body 2.67 inches, of the tail 3.30 inches, of the dorsal fin 0.6 inch. Mexico; Bahia.

At our request, our friend, Dr. Franz Steindachner has kindly examined the types of *Corythroichthys albirostris*. He writes (May 27, 1894): "Das Wiener Museum besitzt 3 Exemplaren von *C. albirostris*; wahrscheinlich wurde 1 Exemplar an Kaup gesendet. Die Zahl der knöchernen Ringe betragt $\frac{18-19}{1 \text{ mal } 26} + 26-28$, und zwar 2 mal 19, 1 mal 18 + 2 mal 28." In the number of plates this agrees with the type of *zatropis*. There is little doubt that *Siphostoma zatropis* and *S. albirostris* are identical.

(Sauvage.) A strongly marked species, noteworthy for the very small number of caudal rings and the proportionally large number of body rings and dorsal rays.

*Syngnathus cayennensis*, SAUVAGE, Bull. Soc. Philom. Paris, 1882, Cayenne.

## 345. DORYRHAMPHUS, Kaup.

*Doryrhamphus*, KAUP, Lophobranchii, 1856, 54, (*excisus*).
*Chœroichthys*, KAUP, *l. c.*, 54, (*valenciennesi*).
*Doryichthys*, KAUP, *l. c.*, 56, (*bilineatus*).
*Microphis*, KAUP, *l. c.*, 63, (*cuneatus*).
*Belonichthys*, PETERS, Mossamb. Flussfische, 109, 1868, (*zambezensis*).

This genus differs from *Siphostoma* chiefly in the position of the egg pouch of the male, which is under the abdomen instead of the tail. The angles of the body are strongly ridged. Tail shorter than body. Tropical seas. (*δόρυ*, lance; *ῥάμφος*, snout.)

DORYICHTHYS:
- *a.* Snout elongate and compressed, devoid of spines; tail four-cornered.
  - *b.* Rings about 20 + 25; dorsal rays 43. LINEATUS, 1136.

DORYRHAMPHUS:
- *aa.* Snout with a row of spines or serrations above; angles of body all serrated.
  - *bb.* Rings 20 + 16; dorsal rays 25. CALIFORNIENSIS, 1137.

### Subgenus DORYICHTHYS, Kaup.

### 1136. DORYRHAMPHUS LINEATUS (Valenciennes).

Head 5 in total length; snout 1⅔ in head. Rings 19 to 22 + 23 to 27. Dorsal 42 to 44, on 2 or 3 + 7 rings. Edges of the shields rough, with prominent spines in young individuals which disappear in the adult. Lateral line uninterrupted, passing into the lower edge of the tail. Body compressed, opercle with a distinct longitudinal ridge, and a few faint radiating lines beneath; origin of dorsal fin considerably in advance of vent; vent nearer end of tail than to gill opening. Ground color yellowish brown. Snout with 5 or 6 black crossbars beneath. (Günther.) Tropical parts of Atlantic from Cuba to Africa; probably not rare, (*lineatus*, streaked.)

*Doryichthys lineatus*, (VALENCIENNES MS.) KAUP, Lophobranchii, 59, 1856, Bahia, Mexico, and Guadeloupe; POEY, Synopsis, 180, 1867; GÜNTHER, Cat., VIII, 183, 1870.
*Doryichthys aculeatus*, KAUP, Lophobranchii, 61, 1856, Egypt.

### Subgenus DORYRHAMPHUS.

### 1137. DORYRHAMPHUS CALIFORNIENSIS, Gill.

D. 25. Rings 20 + 16. Snout half as long as head, its crest formed of about 10 irregular teeth, behind which are 2 others. Double frontal crest well serrated. Ridge under orbit unarmed, but on side of snout it is well serrated. Chin prominent but unarmed. Pectorals as long as opercle. Caudal as long as snout. Yellowish brown, with a black streak from snout to axil. Cape San Lucas. (Gill.) The types are lost and no specimens have been since recorded.

*Doryrhamphus californiensis*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 284, Cape San Lucas. (Coll. Xantus.)
*Doryichthys californiensis*, GÜNTHER, Cat., VIII, 186, 1870.

## 346. SYNGNATHUS, Linnæus.

*Syngnathus*, ARTEDI, Genera, 1738, (*ophidion*, *acus*, *typhle*, etc.).
*Syngnathus*, LINNÆUS, Syst. Nat., Ed. x, 1758, 336, (*typhle*, *acus*, *ophidion*, *æquoreus*, etc.).
*Syngnathus*, RAFINESQUE, Caratteri, 18, 1810, (restricted to *æquoreus*).
*Nerophis*, RAFINESQUE, Indice Ittiol. Sicil., 57, 1810, (*ophidion*).
*Acus* (WILLUGHBY) SWAINSON, Nat. Hist. Anim., II, 333, 1839, (*æquoreus*).
*Scyphius*, RISSO, Europe Mérid., III, 185, 1826, (*fasciatus*).
*Nematostoma*, EICHWALD, 1839, *fide* Kaup.

Small pipefishes with the body smooth, rounded, the ridges indistinct. No pectoral fin; caudal rudimentary or wanting, the tail tapering to a point. Dorsal moderate, opposite the vent. Eggs attached to the loose skin of the abdomen of the male, and not covered by lateral folds. Species few, mostly of the Atlantic. (*σύν*, together; *γνάθος*, jaw.)

SYNGNATHUS:

*a*. Caudal fin rudimentary, with 5 rays. Rings 28 to 30 + 60 to 70; dorsal 38 to 44.
ÆQUOREUS, 1138.

### Subgenus SYNGNATHUS.

### 1138. SYNGNATHUS ÆQUOREUS, Linnæus.

(OCEAN PIPEFISH.)

Rings 28 to 30 + 68 to 70; dorsal 38 to 44. Caudal fin rudimentary, very indistinct. Vent opposite the posterior third of the dorsal fin, before the middle of total length. Snout about 2 in head. Head 3⅝ to 4½ in distance to vent. All the shields smooth. (Günther.) Northern and western coasts of Europe; also in the open Atlantic and recorded from the Gulf of Mexico. If *Syngnathus heckeli* and *S. martinicensis* are the same, it is probably not rare in the Caribbean Sea. (*æquoreus*, belonging to the sea.) (Eu.)

*Syngnathus æquoreus*, LINNÆUS, Systema Naturæ, Ed. x, 417, 1758, open Sea; GÜNTHER, Cat., VIII, 191, 1870.
*Syngnathus sibbaldi*, WALBAUM, Artedi, 6, 1792, Scotland; after SIBBALD.
*Nerophis maculata*, RAFINESQUE, Indice Ittiol. Sic., 57, 1810, Palermo.
*Nerophis anguineus*, KAUP, Lophobr., 65, 1856, Brownsey; Dorsetshire; Berwick.
*Nerophis heckeli*,* KAUP, Lophobr., 66, 1856, Bogota.
*Nerophis*† *martinicensis* (BIBRON) KAUP, *l. c.*, 67, Martinque.

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* *Syngnathus heckeli* (KAUP):

Rings 28 + 67. Dorsal 38 or 39, on 3 + 7 rings. Caudal fin rudimentary, with 5 rays. Tail a little longer than body. Anterior margin of orbit occupies the middle of length of head. Length of head ⅗ of its distance from vent. Bogota. (Kaup.)

† *Syngnathus martinicensis* (BIBRON):

Rings 28 + 64. D. 42. Snout as long as rest of head. Resembles *S. æquoreus*, but is blackish, with a longer tail. Martinique. (Kaup.)

## 347. OSPHYOLAX, Cope.

*Osphyolax*, Cope, Proc. Ac. Nat. Sci. Phila., 1875, 450, (*pellucidus*).

Pectoral fins wanting; tail subcylindric. Body covered with thin, weakly keeled scuta, which have on the lumbar region free superior edges, which form a series of longitudinal lateral grooves. Lateral dorsal scutes produced upward, and approximated on the middle line, inclosing a tube for a distance anterior to the dorsal fin. Dorsal fin short, above the vent. No ventral nor caudal pouch; caudal fin rudimental. This genus is related to *Syngnathus*, but is different from known forms in its curious dorsal tube. What the purpose of this can be is uncertain, but the strong lateral channels below it on each side are probably an adaptation for the carrying of the eggs. In the type species the dorsal tube is closed above by a series of small radiate ossicles in the median line, between which the cavity may be entered by small bodies. The same specimen displays a narrow, free dermal membrane on the middle lines of the upper and lower surfaces from the thoracic to the beginning of the lumbar region. Open sea. (*ὀσφύς*, small of the back; *ὦλαξ*, a tube.)

### 1139. OSPHYOLAX PELLUCIDUS, Cope.

Head 11 in length; snout 2 in head. Three longitudinal series of scuta on each side of body, and one on middle line below. They are rounded at the intersecting angles, thus leaving a vacancy, which is covered by a small, round scale. Each scute with a low median keel, from which delicate transverse ridges diverge. The two lower lateral series are the ones which form the lumbar grooves. Two nuchal scuta. Parietal and frontal regions impressed, punctate; operculum radiate; sides of muzzle smooth. Thirty-one transverse rows of scuta. Dorsal radii sixteen. Length 9 inches; tail equal to rest of body. Color pellucid, the back tinged with brownish. (Cope.) Open Atlantic. Not seen by us. (*pellucidus*, transparent.)

*Osphyolax pellucidus*, Cope, Proc. Ac. Nat. Sci. Phila., 1875, 450, plate xxv, figs. 1 to 4, open Atlantic Ocean. (Coll. Capt. J. Mortimer.)

## 348. HIPPOCAMPUS,[*] Rafinesque.

### (The Sea-horses.)

*Hippocampus*, Rafinesque, Indice d'Ittiologia Siciliana, 37, 1810, (*hippocampus*).

*Hippocampus*, Leach, Zoöl. Misc., 1814, 103, (*hippocampus*).

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[*] The following European species has been several times recorded from our coast, but probably either *Hippocampus hudsonius* or *H. punctulatus* has been mistaken for it.

*Hippocampus hippocampus* (Linnæus):

Dorsal fin with 20 (19) rays. Tubercles generally well developed on the head and body, and subacute, rarely blunt. Length of the snout equal to the distance between the hind margin of the orbit and gill opening. Spines on the head and neck sometimes with simple filaments. Brown, with bluish-white dots, more or less confluent into lines on the lower part of the side and gill cover; dorsal fin with a black submarginal band. Coasts of southern Europe, north to England; abundant in the Mediterranean. Brown, the sides profusely spotted with white, the snout plain.

*Syngnathus hippocampus*, Linnæus, Syst. Nat., Ed. x, 1758, 338, open sea.

*Hippocampus heptagonus*, Rafinesque, *l. c.*, 37, 1810.

Body strongly compressed, the belly gibbous, tapering abruptly to a long, quadrangular, prehensile tail. Head with a distinct curved neck, placed nearly at a right angle with the direction of the body, surmounted by a compressed occipital crest, on the top of which is an angular, star-shaped coronet; top and sides of the head with spines. Physiognomy remarkably horse-like, like that of a conventional "knight" at chess. Body and tail covered with bony plates, forming rings, those on the body each with six spines or tubercles, those of the tail with 4. Pectoral fins present, short and broad; anal minute, usually present; dorsal fin moderate, opposite the vent. Egg pouch in the male a sac at the base of the tail, terminating near the vent. Species numerous, in all warm seas. They attach themselves by their tails to seaweed and other floating substances, and are often carried to great distances by currents. (*ἱππόκαμπος*, the ancient name, from *ἵππος*, horse; *κάμπος*, a wriggling sea monster, or a caterpillar.)

*a.* Dorsal fin large, with 19 rays.
  *b.* Rings 10 + 38; slender, the tail longer than head and body; body unicolor or sparsely dotted with white. INGENS, 1140.
  *bb.* Rings 11 + 32 to 35; depth of body equals length of head; snout $2\frac{1}{3}$ in head; dorsal fin on $3\frac{1}{2}$ + 0 rings; body mottled, not dotted. HUDSONIUS, 1141.
*aa.* Dorsal fin smaller, with 16 to 18 rays.
    *c.* Dorsal fin with 17 or 18 rays, on 2 caudal rings; snout short, less than half length of head; light-blue spots on head and snout; head usually without filaments; size large. PUNCTULATUS, 1142.
    *cc.* Dorsal fin with 16 rays, on 4 + 0 rings; rings 12 + 31; snout longer than postocular distance; body unspotted; size moderate. STYLIFER, 1143.
*aaa.* Dorsal fin very small, with 12 rays, on 2 + 1 rings; rings 11 + 30; snout very short; body without white spots. ZOSTERÆ, 1144.

### 1140. HIPPOCAMPUS INGENS, Girard.

(CABALLITO DEL MAR.)

D. 19, on 3 + 2 rings; A. 4. Rings 11 + 36 to 38; eye moderate, $2\frac{1}{3}$ in snout, which is $2\frac{1}{4}$ to $2\frac{1}{3}$ in head, rather than opercle. Body in male rather slender, its greatest depth in males $1\frac{1}{5}$ in head, or about equal to the distance from snout to posterior margin of orbit; tail longer than head and body together. Spines on head and body high, with large fringed flaps; supraorbital spine nearly half diameter of eye; coronet well developed, with five spines; surface of plates with many small papillæ, each third to fifth tubercle of dorsal series enlarged; shoulder girdle with 3 tubercles; anterior spine of frontal triangle much lower than the others; female more slender, the depth $1\frac{3}{5}$ in head, the snout equal to rest of head. Color blackish, usually plain, faintly barred with darker; papillæ on body pale, giving an appearance of scattered whitish

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*Hippocampus antiquorum*, LEACH, Zoöl. Misc., 1814, 104; GÜNTHER, Cat., VIII, 200, 1870.

*Hippocampus brevirostris*, CUVIER, Règne Anim., Ed. II, 1829, Venice; after WILLUGHBY; figure of a fresh specimen.

*Hippocampus guttatus*, CUVIER, *l. c.*; also after WILLUGHBY, the type apparently from Venice, a specimen dried and straightened out.

*Hippocampus antiquus* of authors.

specks; a white dot before eye; sometimes whitish streaks behind eye; body sometimes with black dots. Gulf of California in shallow water, scarce; ranging north to San Diego. Here described from three male and one female specimens, each 6 inches long, from Mazatlan. Girard's types, five in number, the largest 9 inches long, from San Diego, where the species is very rare. Pacific Coast of northern Mexico, Cape San Lucas, San Diego; not common; one of the largest sea-horses; reaching a length of nearly a foot. (*ingens*, gigantic.)

*Hippocampus ingens*, GIRARD, Pac. R. R. Surv., Fishes, 342, 1858, San Diego; adult male; JORDAN & GILBERT, Synopsis, 386, 1883.
*Hippocampus gracilis*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 282, Cape San Lucas; adult female. (Coll. Xantus.)

### 1141. HIPPOCAMPUS HUDSONIUS, De Kay.

(COMMON AMERICAN SEA-HORSE.)

D. 19; rings 12 + 32 to 35; depth equal to length of head. Snout 1⅓ in rest of head. Spines of head weak, provided with cirri; spines of body all short and bluntish. Dorsal on 3½ of the 11 rings. Dusky, without spots, but with pale grayish blotches, which are sharply edged with paler and blackish; some of these between eyes and on neck, the most distinct blotch forming an hourglass-shaped figure, extending down each side of the back; similar blotches on belly and tail. Dorsal with a submarginal dark band. Atlantic Coast, from Cape Cod southward to Charleston; not common. (Name from Hudson River.)

*Hippocampus hudsonius*, DE KAY, N. Y. Fauna: Fishes, 322, plate 53, fig. 171, 1842, New York; JORDAN & GILBERT, Synopsis, 907, 1883.
*Hippocampus heptagonus*, JORDAN & GILBERT, Synopsis, 386, 1883; not of RAFINESQUE.
*Hippocampus lævicaudatus*, HECKEL MS., Kaup, Lophobranchii, 16, 1856, North America.*

### 1142. HIPPOCAMPUS PUNCTULATUS, Guichenot.

(CABALLITO DE MAR.)

Dorsal rays 17 or 18. Snout usually a little longer than postorbital part of head. Tubercles on body generally obtuse and blunt; coronet low; supraorbital spine obliquely truncate, compressed; head usually without filaments. Size large. Dark brown, marbled with darker and usually everywhere with light-blue spots which become white in alcoholic specimens; these spots most numerous posteriorly; sometimes these spots are altogether wanting. Tropical parts of the Atlantic, common in the West Indies, Brazil, and Western Africa, occasionally northward in the Gulf Stream as far as Beaufort, N. C. (Jenkins.) A rather large and prettily colored sea-horse. (*punctulatus*, with small dots.)

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* Kaup's description of *Hippocampus lævicaudatus* is as follows: "The dorsal as long as the head, and standing on 5 rings. Body rings 11. The eyes nearly in the middle between the end of the snout and the gill opening. Up to the dorsal fin there are 8 rings. Tail without knobs, and the gill plate silvery."

*Hippocampus punctulatus*, Guichenot, in Sagra, Cuba Poiss., 174, plate 5, fig. 2, 1850, Cuba.
*Hippocampus marginalis*,* Heckel, in Kaup, Lophobr., 15, 1856, Mexico.
*Hippocampus fascicularis*,† Heckel, in Kaup, *l. c.*, 15, 1856, Mexico.
*Hippocampus longirostris*, Kaup, Lophobr., 12, 1856; not of Cuvier.
*Hippocampus guttulatus*, Günther, Cat., VIII, 202, 1870; probably not of Cuvier.
? *Hippocampus kuda*, Bleeker, Nat. Tyds. Ned. Ind., III, 82, East Indies; numerous synonyms of *H. kuda* are quoted by Günther. *l. c.*, but this East Indian species will probably be found different.

### 1143. HIPPOCAMPUS STYLIFER, Jordan & Gilbert.

D. 16, covering about 4 body rings; rings about 12 + 31. Snout notably longer than postorbital part of head; supraocular and temporal spines long, simple; a long median spine in front of coronet; coronet stout, high, its spines slender, abruptly spreading. Spines of body very long and slender, each ending in a filament; these enlarged on each alternate plate of the neck, and about every fourth plate on body and tail; dorsal and upper lateral ridge usually armed and sometimes lower lateral ridge; two strong spines at base of pectoral; body with about 50 developed spinous processes besides numerous smaller points. Brownish, with darker bars; no pale spots; snout blackish. Coasts of Florida, in deep water, known from the "Snapper Banks" off Pensacola and Tampa, and from the Gulf Stream. (*stylifer*, bearing rods or projections.)

*Hippocampus stylifer*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 265, "Snapper Banks." (Type, No. 30876. Coll. Jordan & Stearns); Jordan & Gilbert, Synopsis, 907, 1883.

### 1144. HIPPOCAMPUS ZOSTERÆ, Jordan & Gilbert.

Dorsal 12, on 2 + 1 rings; rings 11 + 30. Snout very short, not more than half rest of head; supraorbital spines diverging, each with a small spine before it. Coronet high, ⅔ length of snout, its filaments about as long as snout. Spines on body well developed. Olive green; sides of head mottled with dusky, its margin (in ♂) broadly red. Length 2 inches. Pensacola Bay; the smallest known species of sea-horse, abundant in shallow water in the lagoons, always found clinging by its tail to the sea wrack, *Zostera marina* (whence the name *zosteræ*).

*Hippocampus zosteræ*, Jordan & Gilbert, Proc. U. S. Nat. Mus.. 1882, 265, Grand Lagoon, Pensacola, Florida. (Type, No. 30852. Coll. Jordan & Stearns.) Jordan & Gilbert, Synopsis, 907, 1883.

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* *Hippocampus marginalis*, Heckel:

Dorsal fin on last three of the twelve body rings. Greatest height of body equal to distance between the coronet and the end of the snout. All the angles of the rings more developed than in *H. longirostris*. White spots besprinkle the head and snout, and the gill plates are crossed by curved black lines; longitudinal black stripes run on the body to the seventh ring, and black cross lines succeed them from the eighth to the twelfth rings; irregular interrupted black lines traverse the belly lengthwise. (Kaup.) Mexico.

† *Hippocampus fascicularis*, Heckel:

Snout longer than that of *H. brevirostris*, with more acute nasal projections, and the dorsal not standing on so high an elevation. Color black, with very many white points. Gill plates striped by 10 or 11 rows of white dots, and between the lateral line and the rim of the belly there are irregular white bands extending as far as to the seventh ring. From the eighth ring to the anus there is between each pair of rings a dark cross line sprinkled with white specks, and marbled. Mexico. (Kaup.)

## Order BB. ACANTHOPTERI.

### (The Spiny-rayed Fishes.)

Anterior vertebræ unmodified and without ossicula auditus; no mesocoracoid and no interclavicles (so far as known). Border of mouth formed by premaxillary; maxillary normally distinct from it and always present, but sometimes coossified with it. Gills laminated. Shoulder girdle attached to the skull by a post-temporal, which is normally furcate and usually not coossified with the skull. Hypercoracoid and hypocoracoid distinct, ossified, the former usually perforate. Pharyngeals well developed, the lower rarely united, the third upper pharyngeal largest, the fourth often wanting. Pectoral actinosts always present, opercular apparatus complete; gill openings in advance of the pectorals; pectoral fins above the plane of the abdomen; ventral fins more or less anterior, normally attached by the pelvis to the shoulder girdle, typically with 1 spine and 5 rays, sometimes wanting, sometimes without spine or with many rays, or otherwise modified. Anterior rays of dorsal and anal typically simple or spinous, but all the fin rays often articulate. Air bladder typically without duct in the adult. Scales various, typically ctenoid; lateral line usually running high. To this group are referable the great body of existing marine fishes. It may be not a perfectly natural order, inasmuch as the members of the group differ very widely among themselves, and at the same time some of them approach very closely to neighboring orders as the *Haplomi*, *Synentognathi*, *Hemibranchii*, etc., groups related to the parent stock of some of the *Acanthopteri*. It is not at all certain that the *Acanthopteri* have all developed from a common stock, nor in many cases can we indicate the genetic relations.

Among the *Acanthopteri* a certain number of well-defined suborders exist—branches more or less separable from the parent stem. It is impossible, however, to divide the whole group into suborders, as many of the constituent groups cannot be defined. Thus the *Percesoces*, *Tæniosomi*, *Heterosomata*, *Sclerodermi*, *Gymnodontes*, etc., can be easily segregated and defined, while other groups clustering around equally well-marked forms can not receive any sort of concise and inclusive definition. Examples of this are the *Scombroidei*, *Percoidei*, *Trachinoidei*, and the like. But these large groups can not be all referred to a single suborder, as they differ as much *inter se* as the well-defined suborders do.

We have here adopted the anomalous system of recognizing two sorts of subordinate divisions within the order of *Acanthopteri*, the "suborders" or categories susceptible of definition, and "groups" which can only be defined through alliance with some central or some parent form. Thus the varied group of *Scombroidei* center about the mackerels, seeming to diverge in various directions from the type of *Scomber*. The difficulty of definition may arise from any one of several sources: (*a*) from the real intergradation of forms; (*b*) from our ignorance of the real characters; or, (*c*) from the intrusion of unrelated forms which obscure the true quality of the group. The presence of intrusive elements has been one of the chief causes of the failure of schemes of classification in the past. The modern fashion of a comparatively minute subdivision of genera and families has this justification, that "Analysis must precede synthesis." The large families and genera recognized by the earlier writers were always disfigured by the retention of "aberrant," that is, unrelated forms. (*ἄκανθα*, spine; *πτερόν*, fin; the word originally written *Acanthopterygii*, but the shortened form seems preferable.)

### Analysis of Suborders and other groups of Acanthopteri.

Note. In the following analysis only the most salient or the most evident characters are mentioned, detailed descriptions being given farther on. The groups called suborders are mostly sharply defined and more or less isolated from the main trunk of the mass of spiny-rayed fishes. The other groups mentioned below are for the most part incapable of precise definition, representing rather centers of relationship. Various aberrant forms receive provisional location pending more exact and detailed study. Thus under the *Scombroidei*, *Berycoidei*, and *Trachinoidei* for example, are here enumerated forms which may have little real affinity with the central family of the group in question. In this connection may be quoted the following pertinent remarks of Dr. Gill (Mem. Nat. Acad. Sci., vi, 128, 1894):

"The author insists, as in previous publications, on the entirely provisional nature of the present arrangement. Changes—grave changes—must necessarily be made in the system when the species shall be studied in a more scientific way than has been generally done heretofore. Many families are entirely unknown in an anatomical point of view, and until their structure has been investigated and carefully compared with that of others, their systematic relations must remain doubtful. No scientific investigator should fear to change his opinion. An obstinate persistence in ancient views because they have been once adopted has been too long detrimental to the interests of systematic ichthyology, and such obstinacy has retarded the general progress of science for twenty to thirty years. While the aspect of every other branch of vertebrate zoölogy has entirely changed within that period, ichthyology, the most complex and the least advanced of all, might appear to the casual observer to have had a more certain basis than any, inasmuch as the text-books of a past generation have essentially the same system as the latest. Either almost omniscience and prescience were the attributes of the guides of the past who keep to the same path in the present, or obstinacy and blindness to an extraordinary degree have been manifested. To a great extent ichthyology has been limited to descriptions of species or habits, and taxonomic principles have been quite neglected.

Meanwhile ichthyology is still a crude and inchoate science. The present list has been prepared as a check-list and adjuvant to the use of the collection. Many families have been allocated in their positions simply because they have been placed there before and because equal doubts would be involved in placing them elsewhere. In many cases, it is certain that the general conceptions of their relations (if so positive a term may be applied to what are vague reiterations of past utterances) are baseless, but the indications furnished by the exterior are insufficient to justify positive conclusions. Until the anatomy or at least the osteology of every family and subfamily is known, much doubt must remain as to the proper allocation of such groups. (Gill.)

**Salmopercæ:** Adipose fin present; dorsal and anal with spines in very small number; ventral fins abdominal, with more than 5 soft rays; vertebræ about 35.

**Xenarchi:** Vent anterior in position; ventral fins thoracic, with more than 5 soft rays; dorsal and anal spines few; tail diphycercal.

**Percesoces**: Ventral fins abdominal, each of 1 spine and 5 rays; dorsal spines few, usually forming a separate fin; gill structures and structure of mouth normal; the tail diphycercal.

**Ammodytoidei**: Ventral fins wanting; no spines in any of the fins. Otherwise essentially as in the *Percesoces.*

**Rhegnopteri**: Pectoral actinosts not alike in form or position, 2 of them normal, supporting the fin, 1 longitudinal without rays, 1 a plate on the coracoid supporting 3 to 10 free elongate rays, separate from the rest of the fin; ventral fins subabdominal. Otherwise essentially as *Percoidei.*

**Berycoidei**: Ventral fins thoracic, typically with 1 spine and more than 5 soft rays. Spines of fins various; squamation various; air duct sometimes persistent; tail diphycercal.

**Scombroidei**: Ventral fins thoracic, typically with 1 spine and 5 soft rays; spines of fins various; caudal peduncle typically slender, with a broad, strongly forked caudal fin; scales typically small and cycloid, but often wanting or bony, or even ctenoid; shoulder girdle normal; gills normal; tail diphycercal.

**Percoidei**: Ventrals thoracic, with 1 spine and 5 rays (rarely I, 4); lower pharyngeals separate (very rarely coalescent); gills 4, a slit behind the fourth; nostrils double on each side; scales typically ctenoid, and usually well developed; post-temporal slender, divided at tip and not coossified with skull; bones of jaws distinct; pectoral actinosts normal; vertebræ 24 to 40; tail diphycercal.

**Squamipinnes**: Post-temporal typically coossified with the skull; maxillaries normal; fins usually scaly; ventrals thoracic, typically with 1 spine and 5 soft rays; vertebræ 24 or fewer; tail diphycercal.

**Sclerodermi**: Post-temporal undivided and coossified with the skull; maxillaries coossified with the premaxillaries and dentaries with the articular; ventral fins reduced or wanting, the pelvic bone very long; jaws with distinct teeth; skin covered with scales or movable plates; spinous dorsal present; vertebræ in reduced number, less than 24; tail diphycercal.

**Ostracodermi**. As above, the body covered with bony immovable scutes, forming a carapace; spinous dorsal obsolete; vertebræ in reduced number.

**Gymnodontes**: As in the *Sclerodermi*, the skin smooth or variously prickly or armed with plates; no spinous dorsal nor ventral fins; teeth coalescent into 1 or 2 bony plates in each jaw; vertebræ in reduced number.

**Cirrhitoide**: Much as in the *Percoidei*, the pectoral very broad, its lower rays simple and thickened.

**Holconoti**: Lower pharyngeals solidly united; young brought forth alive; anal fin very long; scales cycloid; vertebræ more than 24. Otherwise essentially as in the *Percoidei.*

**Chromides**: Nostrils single on each side; lower pharyngeals completely united; gills 3½ or 4, the slit behind last gill present or absent. No labyrinthiform appendage to the gills. Otherwise essentially as in *Percoidei.*

**Pharyngognathi**: Nostrils double; lower pharyngeals fully united, without suture; gills 3½, no slit behind the last; scales cycloid; ventrals thoracic, I, 5; bones of suborbital, jaws, and shoulder girdle normal. Otherwise essentially as in *Percoidei.*

**Cataphracti**: Suborbital with a bony stay extending backward from the suborbital ring to or toward the preopercle; nostrils double; lower pharyngeals separate; bones of jaws and shoulder girdle normal; ventrals thoracic, often reduced, modified or wanting, always close together; pectoral fin simple; vertebræ usually more than 24; tail diphycercal.

**Craniomi**: Suborbital, as in *Cataphracti*, the stay more developed; ventrals I, 5, widely separated shoulder girdle peculiarly modified; the post-temporal forming an integral part of the skull, the posterotemporal crowded out of place above and on each side of post-temporal; pectoral fin divided in two parts or else with free detached rays.

**Gobioidei**: Ventral fins; thoracic, I, 5, typically close together or else united (sometimes widely separated); the inner rays of each fin the longest; gill membranes broadly united to the isthmus; dorsal spines few and weak; soft dorsal and anal long; scales various; nostrils, gills, jaws, suborbital, and shoulder girdle normal; vertebræ usually in small number (about 24); tail diphycercal.

**Discocephali**: Spinous dorsal modified into a lamellated sucking disk, placed on the back of the head; ventrals thoracic, I, 5. Otherwise essentially as in the *Trachinoidei.*

**Trachinoidei**: Ventrals typically thoracic, with 1 spine and 5 rays, but often jugular or with the rays reduced; nostrils, jaws, shoulder girdle, and suborbital normal; scales various; gills 3½ or 4; dorsal spines comparatively few; soft dorsal and anal fins long; tail diphycercal; an undefinable and probably heterogeneous group, its members provisionally left together.

HAPLODOCI: Ventrals jugular, with 2 or 3 soft rays; post-temporal undivided; gills 3, a slit behind the last; no suborbital stay; spinous dorsal very short; no pseudobranchiæ; tail diphycercal.

XENOPTERYGII: Ventrals wide apart, I, 4 or I, 5, a broad sucking disk formed of folds of skin between them; no spinous dorsal; no suborbital ring; no scales; tail diphycercal.

BLENNIOIDEI: Ventrals jugular, usually with 1 spine; less than 5 soft rays, often wanting; dorsal fin very long, its anterior portion composed of numerous spines; hypercoracoid perforate; shoulder girdle, jaws, nostrils, and suborbital normal; tail diphycercal; pseudobranchiæ present; scales usually small and smooth, often wanting; vertebræ numerous.

OPHIDIOIDEI: Ventrals without spines; no spines in the anterior portion of dorsal fin. Otherwise essentially as in the *Blennioidei*, the tail diphycercal, the last vertebræ sometimes much reduced.

ANACANTHINI: Ventrals jugular, of soft rays only, the number usually more or less than 5; no spines in any of the fins; hypercoracoid imperforate; tail isocercal; no pseudobranchiæ; gills, nostrils, pharyngeals, suborbital, and shoulder girdle normal; vertebræ numerous.

TÆNIOSOMI: Body ribbon-shaped; the ventrals thoracic, the rays usually less than I, 5; post-temporal undivided; skin smooth or prickly; caudal fin wanting or else divided and peculiar. Skin naked or prickly; vertebræ very numerous.

HETEROSOMATA: Cranium twisted so that both eyes in the adult are on the same side of the head; dorsal and anal fins very long; no spines in the fins; ventrals thoracic, of more than 5 soft rays; coracoids normally developed, the hypercoracoid perforate; tail diphycercal; pseudobranchiæ present; vertebræ in increased number.

## Suborder SALMOPERCÆ.

### (THE TROUT PERCHES.)

We place provisionally as a suborder of the *Acanthopteri*, a singular group of archaic fishes, relics* of some earlier fauna, and apparently derived directly from the extinct transitional forms through which the *Haplomi* and *Acanthopteri* have descended from allies of the *Isospondyli*. The group shows the remarkable combination of true fin spines, ctenoid scales, and a percoid mouth, with the adipose fin, abdominal ventrals, and naked head of the *Isospondyli*. The relations of the *Percopsidæ* with such archaic spiny-rayed fishes as *Aphredoderus* and *Elassoma* are certainly not remote and the close resemblance of the head of *Percopsis* to that of *Gymnocephalus* (*Acerina*) may be more than accidental. The suborder may be provisionally defined as follows:

Ventrals abdominal, each with a short simple ray; dorsal with 2 simple rays or spines; anal with 1 or 2; mouth formed as in Percoid fishes, the simple toothless maxillary not forming part of its border. Adipose fin present. Scales ctenoid; head naked; pseudobranchiæ present. Air bladder apparently with a rudimentary duct. Stomach siphonal, with a few cœca. Shoulder girdle without mesocoracoid, apparently of the normal percoid type; vertebræ about 35. A single family. (*Salmo*, trout; *Perca*, perch.)

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* In describing *Percopsis*, Agassiz refers to it as a generalized type and relic of an older fauna. He says: "Now, the genus *Percopsis* is as important to the understanding of modern types as *Lepidosteus* and *Cestracion* are to the understanding of the ancient ones, as it combines characters which in our day are never found together in the same family of fishes, but which, in more recent geological ages, constitute a striking peculiarity of the whole class. My *Percopsis* is really such an old-fashioned fish, as it shows peculiarities which occur simultaneously in the fossil fishes of the Chalk epoch, which, however, soon diverge into distinct families in the Tertiary period never to be combined again. Now my new genus *Percopsis* is a just intermediate between *Ctenoids* and *Cycloids*; it is what an ichthyologist at present would scarcely think possible, a true intermediate type between Percoids and Salmonidæ." (Agassiz, Lake Superior, 285, 1850.)

## Family CIV. PERCOPSIDÆ.

### (THE SAND ROLLERS.)

Body moderately elongate, somewhat compressed, the caudal peduncle long and slender. Head conical, pointed, naked. Mouth small, horizontal; maxillary short, narrow, without supplemental bone, not reaching to the large eye; margin of upper jaw formed by premaxillaries alone, which are short and not protractile. Teeth very small, villiform on premaxillaries and lower jaw only. Tongue short, adherent. Gill membranes separate, free from the isthmus. Pseudobranchiæ present. Branchiostegals 6. Gill rakers short, tubercle-like. Opercle with entire edges. Lower limb of the preopercle well developed, the angle nearly a right angle, its inner edge with a raised crest, its outer edge crenulate or with a few spines. Bones of the head cavernous, as in the Percoid genus *Acerina*; cranium with a raised crest, which does not extend to the occiput. Scales moderate, rather firm, adherent, their edges strongly ctenoid. Lateral line continuous. Dorsal short, median, with 2 spines, slender or stout; ventrals anterior, just in front of the dorsal, with 1 rudimentary spine and about 8 rays; pectorals narrow, placed rather higher than usual in *Isospondyli*; anal small, with 1 or 2 spines; caudal forked; adipose fin present, small. Vertebræ about 35. First superior pharyngobranchial without teeth: second, third, and fourth separate, with teeth. Lower pharyngeals separate. Stomach siphonal, with about 10 well-developed pyloric cœca. Ova unusually large, not falling into the abdominal cavity before exclusion. Air bladder present, with a band of connective tissue which is apparently with a rudimentary duct. Small fishes of the fresh waters of the cooler parts of America; two genera known, each with probably but one species. The group is one of special interest, as it combines with ordinary Salmonoid characters the structure of the head and mouth of a Percoid, resembling notably the European genus *Gymnocephalus* or *Acerina*. The late discovery by Dr. Eigenmann of a second genus, still more decidedly percoid in its structure is the most interesting recent addition to our knowledge of American fishes. (*Percopsidæ*, Günther, Cat., VI, 207, 1866.)

*a.* Dorsal fin with 2 feeble, slender spines or simple rays; anal with 1 slender spine; scales most strongly ctenoid on caudal peduncle; posterior margin of preopercle entire or with feeble crenulations; lateral line developed, the tubes small; form slender, the body translucent. PERCOPSIS, 349.

*aa.* Dorsal and anal each with 2 very strong spines; ventral spine evident; scales most strongly ctenoid on anterior part of body; posterior margin of preopercle with a few short but strong spines; lateral line imperfect, the tubes more or less obsolete; form robust, the substance comparatively opaque. COLUMBIA, 350.

### 349. PERCOPSIS, Agassiz.

*Percopsis*, AGASSIZ, Lake Superior, 284, 1850, (*guttatus*).
*Salmoperca*, THOMPSON, App. Hist. Vermont, 33, 1853, (*pellucida* = *guttatus*).

Body rather slender, pellucid, covered with rather thin scales. Dorsal fin with 2 slender spines or simple rays; anal with 1; scales roughest posteriorly; lateral line developed; preopercle entire or very nearly so. Vertebræ 17 + 17 = 34. Atlantic Slope, in cold or clear lakes and rivers. (*πέρκη*, perch; *ὄψις*, appearance.)

### 1145. PERCOPSIS GUTTATUS, Agassiz.

(SAND ROLLER; TROUT PERCH.)

Head 3⅘; depth about 4⅛. D. II, 9; A. I, 7; V. I, 8; scales 50. Head slender and conical; mouth small, subinferior, maxillary not nearly reaching front of orbit. Caudal peduncle long and slender. Pale olivaceous, a silvery stripe along the lateral line, becoming obsolete forwards; upper parts with obscure round dusky spots made of dark points. Peritoneum silvery. Length 6 inches. Spawns in spring. Delaware River (Abbott) to Ohio River (Sloan; Gilbert); Kansas and northward; very abundant in the Great Lakes; in all streams tributary to Hudson Bay, Red River of the North, and found by Dr. Eigenmann in the Saskatchewan as far as Medicine Hat; rare in streams south of Lake Erie, although occasionally taken throughout the upper Mississippi Valley. (*guttatus*, spotted.)

*Percopsis guttatus*, AGASSIZ, Lake Superior, 286, 1850, Lake Superior; GÜNTHER, Cat., VI, 207, 1866; JORDAN & GILBERT, Synopsis, 322, 1883; EIGENMANN, Science, Oct. 21, 1892, 233.

*Salmoperca pellucida*, THOMPSON, Appendix Hist. Vt., 33, 1853, Lake Champlain. (Coll. Thompson.)

*Percopsis hammondi*,* GILL, Proc. Ac. Nat. Sci. Phila., 1864, 151, Kansas. (Coll. Hammond.)

## 350. COLUMBIA, Eigenmann & Eigenmann.

*Columbia*, EIGENMANN & EIGENMANN, Science, Oct. 21, 1892, 233, (*transmontana*).

Body rather robust, little translucent, covered with strongly ctenoid scales which are roughest anteriorly; lateral line obscure or imperfect; angle of preopercle with a few stoutish spines. Dorsal and anal fins each with two very strong spines; a short ventral spine. One species, in rivers of the Pacific slope. (Named for the Columbia River, itself for John Kendricks's ship, the *Columbia*; the name derived from that of Cristiforo Colon, who came to America just four hundred years before this fish was discovered.)

### 1146. COLUMBIA TRANSMONTANA, Eigenmann & Eigenmann.

Head 3 to 3½; depth 3½ to 4; eye 3¼, equal to snout. D. II, 9; A. II, 6; scales 7 to 9–44 to 46–7. Body comparatively deep, the dorsal profile more arched than the ventral, making an angle at origin of dorsal; sides compressed, the tail most so. Head short and chubby. First dorsal spine as long as pupil; second half length of head, recurved, very deeply grooved behind; anal spines lower than dorsal spines, the second longest; ventrals reaching past vent; nape scaled. Semitranslucent smutty green; sides with three rows of oblong blackish spots, the middle and upper most distinct; back with a series of similar spots, one conspicuous at beginning and another at end of first dorsal; dorsal mottled; caudal barred; head smutty; a blue-black spot on middle of opercle; a narrow, silvery lateral band; young translucent, with dark spots. Length 3 to 4 inches.' Sandy or weedy lagoons along the Columbia River, locally abundant at the mouth of the Umatilla and Wallula rivers; our specimens taken by Thoburn and Rutter in the Wallula at Walla Walla. (*transmontanus*, beyond the mountains.)

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* Head larger, 3½ in length, exclusive of caudal; dorsal higher, the longest ray 4⅔ in length; anal higher, longest ray 6 in length; pectoral equals height of dorsal; ventral 5¾ in length, reaching vent, which is nearer snout than margin of caudal fin. Kansas. (Gill.)

*Columbia transmontana*, Eigenmann & Eigenmann, Science, Oct. 21, 1892, 233, mouth of Umatilla River, Oregon; (Coll. Eigenmann); Gilbert & Evermann, Investigations in the Columbia River Basin, 51, 1894.

## Suborder XENARCHI.

We place in a distinct suborder, next to the *Salmopercæ*, the singular little family of the Pirate Perches, which finds its natural position between the *Percopsidæ* and the Percoid forms. Structure of mouth and skeleton so far as known essentially that of the Percoid fishes. Dorsal fin single, with few small spines; ventrals thoracic, with a small spine, and more than five soft rays. Air duct not examined, probably obsolete, the air bladder large and adherent. Intestinal canal ending at the throat in the adult, the vent variously posterior in the young. Vertebræ 29. One family among existing forms. Several fossil genera. (*Erismatopterus*, *Amphiplaga*, etc.) seem to stand between *Aphredoderus* and *Elassoma*, which seem to be near relatives on the one hand, as *Percopsis* is on the other. (ξένος, strange; ἀρχός, anus.)

### Family CV. APHREDODERIDÆ.

### (The Pirate Perches.)

Body oblong, elevated at the base of the dorsal, compressed behind, the head thick and depressed, the profile concave. Caudal peduncle thick. Mouth moderate, somewhat oblique, the lower jaw projecting; maxillary reaching to anterior border of the eye. Teeth in villiform bands on jaws, vomer, palatines, and pterygoids. Premaxillaries not protractile; maxillaries small, without evident supplemental bone. Preopercle and preorbital with their free edges sharply serrate; opercle with a spine. Bones of skull somewhat cavernous. Sides of the head scaly. Lower pharyngeals narrow, separate, with villiform teeth. Gill membranes slightly joined to the isthmus anteriorly. Gill rakers tubercle-like, dentate. Pseudobranchiæ obsolete. Gills 4, a small slit behind the fourth. Branchiostegals 6. Scales moderate, strongly ctenoid, adherent. Lateral line imperfect or wanting. Vent always anterior, its position varying with age,* from just behind the ventral fins in the young, to below the preopercle in the adult. Dorsal fin single, median, high, with but 3 or 4 spines, which are rapidly graduated, the first being very short. Anal small, with two slender spines; ventral fins thoracic, with a very short spine, the number of soft rays usually 7; caudal fin rounded behind. Air bladder simple, large, adherent to the walls of the abdomen. Vertebræ 14 + 15. Pyloric cœca about 12. A single genus, with probably but one species, confined to the United States. Its relations are most close to *Columbia* and *Percopsis* among living fishes, but it differs strikingly from these in the loss of the archaic characters of the adipose fin and the abdominal ventrals. The position of the vent is not seen in any closely related group, but reappears in the *Amblyopsidæ*, likewise an ancient type without close relationships among living fishes. (*Aphredoderidæ*, Günther, Cat., I, 271, 1859.)

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* This singular fact was first noticed by Prof. Stephen A. Forbes.

## 351. APHREDODERUS, Le Sueur.

(PIRATE PERCHES.)

*Aphredoderus*, LE SUEUR, in Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 445, 1823, (*gibbosus* = *sayanus*).

*Sternotremia*, NELSON, Bull. Ills. Lab. Nat. Hist., I, 39, 1876, (*isolepis*).

*Asternotremia* (NELSON) JORDAN, Bull. U. S. Nat. Mus., X, 52, 1877, (*isolepis*; *Sternotremia* being regarded as anatomically incorrect).

Characters of the genus included above. (*ἄφοδος*, excrement; *δέρη*, the throat, from the position of the vent; hence more correctly *Aphododerus*.)

### 1147. APHREDODERUS SAYANUS (Gilliams).

(PIRATE PERCH.)

Head 3; depth 3. D. III, 11 to IV, 10; A. II, 6; V. 7; B. 6; scales 45 to 60. Color dark olive, profusely speckled with dark points, which often make blackish streaks along rows of scales; 2 blackish bars at base of caudal, between which is a light bar. Length 5 inches. Sluggish streams and bayous from New York coastwise to Texas, and throughout the Mississippi basin in lowlands and streams with alluvial bottoms; locally abundant, variable. The singular variations in the position of the vent have given rise to two nominal species and a nominal genus.* Northwestern specimens, Ohio to Arkansas (var. *isolepis*) have usually smaller scales than the true *sayanus*. *Sayanus* has 45 to 55; *isolepis* usually 55 to 60; both forms are extremely variable and probably no constant differences exist. (Named for Thomas Say, the distinguished entomologist.)

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* "A study of the position of the vent in *Aphododerus sayanus* has developed some singular things. It becomes evident from the examination of a large series that the position of the vent is not a character of generic importance, as was supposed when the genus *Sternotremia* was proposed, nor is it apparently an individual or a sexual character as has been since suggested. The observations of Professor Forbes, verified by myself, appear to show that the position of the vent is dependent on the *age* of the fish. In the adult the vent is jugular, close behind the little projecting knob at the throat. In the youngest specimens examined, it is more or less behind the ventral fins. In specimens intermediate in size, its position is intermediate, the degree of advancement being proportionate to the size of the fish.

"Occasional irregularities occur, but the above rule holds so generally that it can not be merely accidental. From it I infer that in the very young the position of the vent will be found to be

*Scolopsis sayanus*, Gilliams, Journ. Ac. Nat. Sci. Phila., iv, 1824, 81, near Philadelphia.

*Aphredoderus gibbosus*, Le Sueur, in Cuvier and Valenciennes, Hist. Nat. Poiss., ix, 448, 1833, Lake Pontchartrain.

*Sternotremia isolepis*, Nelson, Bull. Ill. Lab. Nat. Hist., i, 39, 1876, Calumet River, Illinois.

*Aphododerus cookianus*, Jordan, Proc. Ac. Nat. Sci. Phila., 1877, 60, Sawyer's Creek, Kendallville, Indiana. (Coll. Dr. G. M. Levette.)

*Asternotremia mesotrema*, Jordan, Bull. U. S. Nat. Mus., x, 52, 1877, Flint River, Georgia. (Type, No. 9296. Coll. Hugh M. Neisler.)

*Aphredoderus sayanus*, Jordan & Gilbert, Synopsis, 460, 1883; Blatchley, Proc. Ac. Nat. Sci. Phila., 1885, 136.

In a natural system, the *Percopsidæ* should apparently be followed by the *Aphredoderidæ*, *Elassomidæ*, and *Percidæ*, the great modern group of spiny-rayed fishes having doubtless originated from some such stock as that of which the *Percopsidæ* form a remnant. The exigencies of a linear arrangement require us to interrupt the series to find place for the groups *Percesoces*, *Rhegnopteri*, and *Berycoidei*, probably archaic, transitional or degenerate types, of diverse relations, but all of them branching off from the physoclystous stock before the character of the spinous fins had reached its full development.

## Suborder PERCESOCES.

Ventral fins abdominal, I, 5; branchial arches well developed, the bones all present except the fourth superior branchihyal. Third superior pharyngeal much enlarged; lower pharyngeals distinct. Scales cycloid. Pectorals elevated, about on a level with the upper posterior angle of operculum; spinous dorsal usually present.

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as usual in Percoid fishes; as in the young flounder the eyes are symmetrical, but as the fish grows older, its aberrant characters become developed.

"The following table shows the position of the vent in 26 specimens:

| Length of fish. | Position of vent. | Length of fish. | Position of vent. |
|---|---|---|---|
| *Inches.* | | *Inches.* | |
| 1 | Opposite middle of ventrals. | 2¼ | Between bases of ventrals. |
| 1 | Opposite middle of ventrals. | 2¼ | Between bases of ventrals. |
| 1 | Opposite middle of ventrals. | 3 | In front of ventrals, ⅗ of the distance from base of ventrals to the throat "knob." |
| 1 | Opposite middle of ventrals. | | |
| 1¼ | Opposite anterior ⅖ of ventrals. | | |
| 1¼ | Opposite anterior ⅓ of ventrals. | 3 | 4/7 distance to "knob" (about as in types of "*A. mesotrema*"). |
| 1¼ | Opposite anterior ⅓ of ventrals. | | |
| 1¼ | Opposite anterior ⅓ of ventrals. | 3¼ | 4/7 distance from ventrals to "knob." |
| 1¼ | Opposite anterior ⅓ of ventrals. | 3½ | ⅖ distance to the "knob." |
| 1¼ | Opposite anterior ⅓ of ventrals. | 3½ | ⅔ distance to the "knob." |
| 1½ | Opposite anterior ¼ of ventrals. | 4 | Halfway from ventrals to "knob." |
| 1½ | Opposite anterior ¼ of ventrals. | 4¼ | 7/9 distance to "knob" (as in "*A. cookianus*," and in *A. sayanus*). |
| 1½ | Opposite middle of ventrals. | | |
| 1¾ | Just behind base of ventrals. | 4¼ | 7/9 distance to "knob." |
| 2 | Between bases of ventrals (as in type of "*S. isolepis*"). | 4¼ | ⅞ distance to "knob." |

"No other conclusion seems possible from the above except that the vent moves forward as the fish grows older, by the lengthening of the horizontal part of the intestine or "rectum" of the fish. *Sternotremia isolepis* is the young, *Sternotremia mesotrema* the half grown, and *Aphododerus cookianus* the adult of one and the same fish." (Jordan, 1877.)

This group comprises *Acanthopteri*, with the ventral fins abdominal, each of 1 spine and 5 rays, and the pelvic bones not attached to the shoulder girdle; the spinous armature of the fins is less developed, the scales are cycloid, and the opercles unarmed. The suborder marks a transition from soft-rayed to spiny-rayed fishes, its nearest associates among the latter being, perhaps, the Scombroid forms. The families here defined are closely related, but whether other families, as *Ophiocephalidæ*, *Ammodytidæ*, etc., should be included, is not certain. From fishes of the general character of *Percesoces*, the *Hemibranchii* and *Lophobranchii* seem to be descended, and the *Synentognathi* are closely allied. The group is composed chiefly of shore fishes and fresh-water fishes, mostly of small size but some of them large and voracious. (*Perca*, Perch; *Esox*, Pike.)

*a.* Lateral line wanting; teeth small or wanting; gill rakers long and slender.

*b.* Species carnivorous, the body and head elongate; vertebræ more than 35; dorsal spines slender, flexible, 3 to 8 in number; stomach not gizzard-like. ATHERINIDÆ, CVI.

*bb.* Species feeding on mud and vegetation; the head short and broad; vertebræ about 24; stomach gizzard-like, with long intestines. MUGILIDÆ, CVII.

*aa.* Lateral line present; teeth very strong, unequal; gill rakers obsolete; head long and pointed; vertebræ about 24. SPHYRÆNIDÆ, CVIII.

## Family CVI. ATHERINIDÆ.

### (THE SILVERSIDES.)

Body rather elongate, somewhat compressed, covered with scales of moderate or small size, which are usually, but not always, cycloid. No lateral line; some scales often with rudimentary mucous tubes. Cleft of the mouth moderate. Teeth small, on jaws and sometimes on vomer and palatines, rarely wanting. Premaxillaries protractile or not. Opercular bones without spines or serrature. Gill openings wide, the gill membranes not connected, free from the isthmus; gills 4, a slit behind the fourth. Pseudobranchiæ present; gill rakers usually long and slender. Branchiostegals 5 or 6. Dorsal fins 2, well separated, the first of 3 to 8 slender flexible spines, the second of soft rays; anal with a weak spine, similar to the soft dorsal, but usually larger; ventral fins small, abdominal, not far back, of 1 small spine and 5 soft rays; pectorals moderate, inserted high. Air bladder present. No pyloric cœca. Vertebræ numerous, usually about 23+23=46; third and fourth superior pharyngeals coossified, with teeth. Carnivorous fishes, mostly of small size, living in great schools near the shore in temperate and tropical seas; a few species in fresh water; all the species have a silvery band along the side; this is sometimes underlaid by black pigment. Genera about 15; species 60. All of them which are large enough are highly valued as food, hence the common name of "fishes of the king," Pescados del Rey, or Pesce Re, or Peixe Rey. (*Atherinidæ*, Günther, Cat., III, 391-409, 1861.)

*a.* Premaxillaries freely protractile, the skin not continuous with that of the forehead.

*b.* Premaxillary narrow posteriorly, its edge nearly straight. Body little compressed, the belly rounded; pectorals short; scales cycloid; vomer with teeth; first dorsal with 5 to 9 spines, inserted in front of the rather short anal; mouth short. ATHERINA, 352.

- *bb.* Premaxillary broad posteriorly, its edge strongly curved.
  - *c.* Lower jaw strong, projecting beyond the upper.
    - *d.* Scales small, rough, in 70 series; teeth well developed; vomer usually with a few teeth; jaws long. LETHOSTOLE, 353.
    - *dd.* Scales large, smooth, in 38 to 50 series. CHIROSTOMA, 354.
  - *cc.* Lower jaw moderate, its tip included; vomer without teeth.
    - *e.* Jaws not produced into a beak.
      - *f.* Belly not compressed; pectoral short.
        - *g.* Anal moderate, of 15 to 24 rays; first dorsal of about 5 spines, inserted before anal.
          - *h.* Teeth evident, in narrow bands; scales moderate or large, 36 to 56.
            - *i.* Scales laciniate; dorsal and anal scaly. KIRTLANDIA, 355.
            - *ii.* Scales cycloid; soft dorsal and anal mostly without scales. MENIDIA, 356.
          - *hh.* Teeth none, or minute and caducous; scales very small, crenate, about 75. LEURESTHES, 357.
        - *gg.* Anal very long, of 27 rays; the very small first dorsal of 3 spines, inserted over its front; opercle short. EURYSTOLE, 358.
      - *ff.* Belly strongly compressed, its edge forming a more or less distinct keel before ventrals; pectorals very long; first dorsal small, inserted behind front of the long anal.
        - *j.* Scales perfectly smooth. THYRINA, 359.
        - *jj.* Scales rough-ctenoid. ATHERINELLA, 360.
    - *ee.* Jaws produced in a short curved beak; teeth moderate; scales small. LABIDESTHES, 361.
- *aa.* Premaxillaries not freely protractile, the skin of upper jaw mesially continuous with that of the forehead.
  - *k.* Teeth simple, pointed, arranged in villiform bands. ATHERINOPSIS, 362.
  - *kk.* Teeth each bicuspid or with a lateral branch, arranged in one series. ATHERINOPS, 363.

## 352. ATHERINA (Artedi) Linnæus.

### (FRIARS.)

*Atherina* (ARTEDI) LINNÆUS, Syst. Nat., Ed. x, 1758, 315, (*hepsetus*).
*Membras*, BONAPARTE, Fauna Italica, 1836, (no type indicated).

Body oblong, compressed. Mouth large, terminal, oblique; jaws about equal, their edges nearly straight; maxillary extending to the front of eye. Premaxillaries narrow posteriorly, strongly protractile. Villiform teeth in bands on jaws, vomer, and palatines. Species numerous, mostly European. (ἀθερίνη, the ancient name, from ἀθήρ, a spike or arrow.)

- *a.* Anal fin rather short, of 10 to 16 rays.
  - *b.* Scales large, 36 to 40; first dorsal with 5 or 6 spines.
    - *c.* Head very broad, the interorbital width about equal to the large eye, which is about $2\frac{1}{3}$ in head. Scales 36 to 38.
      - *d.* Anal rays I, 12, or I, 13; head about 4 in length. STIPES, 1148.
      - *dd.* Anal rays I, 10 or 11; head $3\frac{1}{2}$ to $3\frac{2}{3}$ in length. LATICEPS, 1149.
    - *cc.* Head narrow and pointed, the large eye much greater than interorbital width; body slender and weak, depth 6 in length; anal I, 12; scales 40. ARÆA, 1150.
  - *bb.* Scales small, 45 to 52; body very slender; first dorsal long, with 7 or 8 spines.
    - *e.* Anal rays I, 11; eye 3 in head; scales 45. HARRINGTONENSIS, 1151.
    - *ee.* Anal rays I, 15; eye $2\frac{1}{2}$ in head; scales 52. CAROLINA, 1152.
- *aa.* Anal fin of about 20 rays; dorsal rays V-I, 15. MICROPS, 1153.

### 1148. ATHERINA STIPES, Müller & Troschel.

Head about 4½; depth about 5. Dorsal V–I, 9 to 11; anal I, 12 or 13; scales 37 to 39–6; eye nearly equal to width of interorbital space, and twice or more times length of snout; maxillary extending beyond the vertical from the anterior margin of the orbit. Distance of end of snout from root of ventral is ⅔ that from the dorsal. A sharp undulated edge forming the upper margin of the orbit. Teeth numerous and distinct in both jaws and on the palate. Two series of small black dots along the side of the tail. (Günther.) Barbadoes. (*stipes*, a log or other stupid object.)

*Atherina stipes*, Müller & Troschel, in Schomburgk, Hist. Barbadoes, 671, 1848, Barbadoes; Günther, Cat., iii, 400, 1861.

### 1149. ATHERINA LATICEPS, Poey.

(Cabezote.)

Head 3½ to 3⅔; depth 4⅖ to 4⅔; eye 2⅓; snout 4; interorbital space 2⅓. Dorsal V–I, 9; anal I, 10 or 11; scales 36–6. Body thick, head very broad, eye large; snout obtuse; top of head broad and flat; cleft of mouth oblique, jaws subequal, maxillary extending beyond front of orbit. Teeth on jaws and vomer, very small. Insertion of spinous dorsal nearer anal than ventral fins. Upper edge of orbit sharp, nearly smooth. Color in life translucent green; silvery below, with a well-defined silvery lateral band, below which a series of dots along the side; back with dark dots forming streaks along the rows of scales; snout above with black dots; fins pale, nearly plain; a dusky shade at base of caudal. Caribbean Sea, north to western Florida, abundant at Key West, Havana, and Cozumel; probably not distinct from *Atherina stipes*, *stipes* being the older name. (*latus*, broad; *ceps*, head.)

*Atherina laticeps*, Poey, Memorias, ii, 265, 1861, Havana.
*Atherina veliana*,* Goode & Bean, Proc. U. S. Nat. Mus., 1879, 342, Clear Water Harbor, Florida. (Type, No. 23629. Coll. Dr. Velie.) Jordan & Gilbert, Synopsis, 405, 1883.
*Atherina stipes*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1884, 116.

### 1150. ATHERINA ARÆA, Jordan & Gilbert.

Head 4½; depth 6. D. VI–I, 9; A. I, 12. Scales 38 to 42. Body very slender, compressed, the head slender and narrow, with sharply pointed snout; mouth oblique, narrow maxillary barely reaching vertical from front of orbit, 2⅔ in head; eye large, equaling interorbital width, 2⅔ in head; scales moderate, entire. Origin of spinous dorsal midway between tip of snout and base of caudal, much behind end of pectorals, about opposite tip of ventrals; length of pectorals equaling depth of body; ventrals half length of head; bases of vertical fins concealed in a sheath of scales. Color, translucent olive green, the snout and mandible dusky; back with a median series of black specks, one on each scale; a similar series on each side the median row; no dark specks on sides; lateral silvery band broad, occupying the greater part of the third row of scales, its width half diameter of orbit; a dusky area behind vent; a series of black specks along base of anal, and thence along caudal peduncle to tail. Gulf of Mexico, at Key West and Cozumel, with *Jenkinsia stolifera*; not rare, but less abundant than *Atherina laticeps.* (ἀραιός, slender.)

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* *Atherina veliana*, Goode & Bean:

Head 3½; depth 4⅔. D. V–I, 9; A. I, 10; scales 36–6½. Snout obtuse; top of head broad and very flat; cleft of mouth somewhat oblique; jaws equal anteriorly; maxillary extending beyond front of orbit. Teeth very small in the jaws and on the vomer. The silvery band occupies the third row of scales, its width less than half the diameter of the eye. Diameter of orbit contained twice in length of head, greater than interorbital width and more than twice the length of the snout. Spinous dorsal beginning behind the vertical from the tips of the ventral fins. (Goode & Bean.) Clear Water Harbor, Florida.

*Atherina aræa*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1884, 27, Key West. (Type, No. 34,967. Coll. Jordan.)

### 1151. ATHERINA HARRINGTONENSIS, Goode.

Head 5¾; depth 8½; eye 3. D. VII–I, 10; A. I, 11; scales 45–6; snout somewhat less than postorbital portion of head, about equal to maxillary, slightly greater than interorbital width, or 2 in greatest width of head; mandible about equal to postorbital portion of head; cleft of mouth oblique, maxillary extending to orbit; lower jaw slightly the longer; mouth very portractile; teeth small, inconspicuous. Spinous dorsal inserted behind extremity of ventrals. at a distance from the snout greater than half length of body; anal directly beneath dorsal, their lengths of base being equal; anal higher than dorsal; length of ventral ⅔ that of pectoral, which is more than ¾ that of head. Greenish white, a narrow silvery band extending from gill opening to tail, covering the third row (from above) of scales and the edges of the contiguous rows above and below. (Goode.) Bermudas. (Named for Harrington Sound in the Bermudas.)

*Atherina harringtonensis*, GOODE, Am. Journ. Sci. & Arts, 3d series, XIV, No. 82, 1877, 297, Bermuda Islands.

### 1152. ATHERINA CAROLINA, Cuvier and Valenciennes.

Head 4½ in total length with caudal; depth 6¾; eye large, 2½ in head. D. VIII–I, 12; A. I, 15; scales 52, nearly or quite entire. Spinous dorsal wholly in advance of vent; ventral fins reaching past front of vent, and dorsal nearly to it. Very similar to *A. hepsetus*, but with the head smaller and the body slenderer. Length 4 inches. Coast of South Carolina; known only from the original type, from which the above description is taken; possibly a specimen of the European species *Atherina boyeri,* wrongly attributed to the coast of South Carolina. It is a true *Atherina.*

*Atherina carolina*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., X, 445, 1835, South Carolina.

### 1153. ATHERINA MICROPS, Poey.

Head 5 with caudal; eye 4 in head. Dorsal V–I, 15; anal I, 19. Mouth small and very protractile. First dorsal a little in front of middle of body; the second as well as the anal is a third longer than in *laticeps.*

Head narrow; eye small. Silvery white; back greenish, with the scales partly spotted with brown. Known only from a drawing made by Poey at Havana. (Poey.) (*μικρός*, small; *ὤψ*, eye.)

*Atherina microps*, POEY, Memorias, II, 266, 1861, Havana.

## 353. LETHOSTOLE, Jordan & Evermann.

*Lethostole*, JORDAN & EVERMANN, new genus, (*estor*).

This genus is allied to *Chirostoma*, with which it agrees in the projecting lower jaw. The jaws are, however, longer than in *Chirostoma*, the scales much smaller and crenate. Fresh waters of Mexico. (*λέθομαι*, to forget; *στολή*, stole.)

### 1154. LETHOSTOLE ESTOR (Jordan).

(PESCADO BLANCO DE CHAPALA.)

Head 3½; depth 6; eye 5. D. V–I, 12; A. I, 18; scales 72–18. Body rather robust. Head very large, pike-like. Mouth very large, the maxillary reaching to past the front of the eye. Intermaxillaries forming the edge of the jaw strongly curved, their posterior portions broadly dilated. Teeth strong, in several series in each jaw. Two small fang-like teeth on the front of the vomer. Lower jaw considerably projecting beyond the upper. Eye large, anterior, shorter than snout, and a little narrower than the interorbital space, which is nearly flat. Head covered with scales, which are smallest on the occipital region, and largest on the lower part of the cheeks; smaller scales on the interopercle. Sides of head vertical, a conspicuous ridge along the edge of the top of the head above and behind the eye. Scales small, anteriorly crowded; posterior margin of scales strongly crenate, so that the fish feels rough to the touch; pectorals moderate, nearly half as long as head, reaching slightly past the base of the ventrals; ventrals rather short, reaching nearly ⅔ the distance to the base of the anal; anal moderate, beginning considerably in front of the dorsal and ending a little behind it; spinous dorsal beginning nearly midway between insertion of ventrals and anal, separated from the soft dorsal by a distance equal to about ⅔ the length of the base of that fin. Caudal somewhat forked. Coloration uniform in spirits, the silvery lateral band but faintly indicated. Length 10¼ inches. Lake Chapala, Guanajuato. One of the largest of the *Atherinidæ*, resembling a pike in its form, and in the large head and mouth. (*estor*, eater, a name applied by Le Sueur to the pike.)

*Chirostoma estor*, JORDAN, Proc. U. S. Nat. Mus., 1879, 298, Lake Chapala, Mexico. (Type, No. 23124. Coll. Professor Dugès.)

## 354. CHIROSTOMA, Swainson.

(PESCADOS BLANCOS.)

*Chirostoma*, SWAINSON, Class'n Fishes, etc., 243, 1839, (*humboldtianum*).
*Atherinoides*, BLEEKER, Verhand. Batav. Genootsch., Japan, XXV, 40, 1853, (*vomerina*).
*Atherinichthys*, BLEEKER, *l. c.*, 40, (*humboldtianum*).
*Heterognathus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 198, (*humboldtiana*).

This genus is distinguished from *Basilichthys* and *Menidia* by the very long and strong mandible, which protrudes beyond the upper jaw. The scales are small, the teeth well developed, there are usually a few vomerine teeth, and the premaxillary is extremely protractile. The known species inhabit Mexico and Brazil. (*χείρ*, hand; *στόμα*, mouth, from the protractile mouth.)

*a.* Scales 42 to 50 in longitudinal series; a patch of teeth on vomer.
  *b.* Anal rays I, 19 or 20; head more than ¼ length. HUMBOLDTIANUM, 1155.
  *bb.* Anal rays I, 15 or 16; head less than ¼ length. BARTONI, 1156.
*aa.* Scales larger, 35 to 37; teeth very weak, none on vomer. JORDANI, 1157.

### 1155. CHIROSTOMA HUMBOLDTIANUM (Cuvier & Valenciennes).

Head 4 in total length; body slender, 5 in total length; eye 6 in head, 2 in snout. D. V–I, 10 or 11; A. I, 19 or 20; scales 50, their edges entire. Pectoral short, broad, pointed, 7 in total length. First dorsal over tip of ventral, which is ⅔ length of pectoral; second dorsal over middle of anal. (Cuvier & Valenciennes.) Two specimens from a lake near the city of Mexico, respectively 11 and 8 inches in length, the types of *humboldtianum* and *vomerinum*. The type of *vomerinum* is said to have slight tooth-like asperities on the vomer. Not seen by us. (Named for Alexander von Humboldt, 1769–1859, the famous author of "Cosmos," who collected fishes in South America and Mexico.)

*Atherina humboldtiana*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., x, 479, 1835, lake near City of Mexico.

*Atherina vomerina*, CUVIER & VALENCIENNES, *l. c.*, 481, lake near City of Mexico.

*Atherinichthys humboldti*, GÜNTHER, Cat., III, 404, 1861; after CUVIER & VALENCIENNES.

### 1156. CHIROSTOMA BARTONI, Jordan & Evermann, new species.

Head 4; depth 6; eye 4; snout 3¼. D. IV–I, 10; A. I, 15; scales 42–10, large and loose, and with entire edges; about 24 scales before the dorsal. Origin of spinous dorsal midway between insertion of ventrals and origin of anal, midway between tip of snout and base of caudal fin. Mouth large, the mandible 1⅔ times the large eye, the premaxillaries very protractile. Teeth well developed on jaws and vomer. Color silvery or straw color; a narrow plumbeous lateral band, edged above with black, along middle of side, indistinct anteriorly but well marked in posterior ¾ of its course; rest of body with scattered brownish punctulations. Length 3½ inches. Only one specimen known (Type, No. 23136), from a tributary of the Rio Lerma, near Guanajuato, Mexico, where it was obtained by Prof. Alfredo Dugès. (Named for Mr. Barton A. Bean, Assistant Curator of Fishes in the United States National Museum.)

*Chirostoma humboldtianum*, JORDAN, Proc. U. S. Nat. Mus., 1879, 299; not of CUVIER & VALENCIENNES.

### 1157. CHIROSTOMA JORDANI, Woolman.

Head 4⅕; depth 4¾. D. IV–I, 8 or 9; A. I, 6; scales 35 to 37. Body elongate, slender, compressed; belly not compressed; head medium, conical; mouth very oblique; mandible deep and short, projecting; premaxillary protractile but not produced; maxillary not reaching eye; teeth very minute or almost obsolete, somewhat movable; eye 4 in head: first rays of anterior dorsal over posterior end of ventrals and slightly in advance of the insertion of the anal; first rays of second dorsal over middle of anal, the rays when depressed reaching as far toward caudal as the rays of anal; length of base of second dorsal about half that of base of anal or equaling distance from snout to posterior edge of orbit: longest rays of second dorsal slightly exceed in length longest rays of anal or about equal the greatest depth, and about ¼ greater than the length of the base. Pectoral fins large, not falcate, 1⅕ in head, inserted above axis of body and reaching to middle of the ventrals, or about equal length of longest dorsal rays; origin of ventrals midway between snout and last rays of anal, extending beyond vent almost to anal; length equal distance from snout to posterior edge of orbit. Eye large and full, longer than snout, about 3 in head; cheeks and opercles scaled, the former with 3 rows of scales; scales all entire, rather firm. Color light olive-green, with narrow but distinct and complete lateral stripe; the 3 rows of scales on back thickly sprinkled with minute dark-brown dots which extend from the snout to the caudal fin. Length 2½ inches. Canals in the City of Mexico and other tributaries of Rio de Lerma. In the City of Mexico this species, together with *Girardinichthys*, is sold in the market, embedded in meal and baked in corn husks. (Woolman.) (Named for David Starr Jordan.)

*Chirostoma brasiliensis*, JORDAN, Proc. U. S. Nat. Mus., 1879, 299; not of CUVIER & VALENCIENNES.
*Chirostoma jordani*, WOOLMAN, Bull. U. S. Fish Comm., XIV, 1894, 62, pl. 2, canals at Salamanca and in City of Mexico. The specimens of "*Atherinichthys brasiliensis*" mentioned by Günther as having been collected by Sallé in Mexico probably belong to this species. The types of *Chirostoma brasiliense* (Quoy and Gaimard) came from Rio Janeiro, and this species is certainly distinct from it.

## 355. KIRTLANDIA, Jordan & Evermann.

*Kirtlandia*, JORDAN & EVERMANN, new genus, (*vagrans*).

This genus is close to *Menidia*, but differs from it in having the scales laciniate and the dorsal and anal fins scaly. Three species known. (Named for Dr. Jared Potter Kirtland, one of the first to study the fishes of Lake Erie and the Ohio Basin.)

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|---|---|
| *a.* Anal rays I, 14 to 18; scales 43 (to 48?). | VAGRANS, 1158. |
| *aa.* Anal rays I, 19 to 21. | |
| *b.* Scales 43. | MARTINICA, 1159. |
| *bb.* Scales 48 to 50. | LACINIATA, 1160. |

### 1158. KIRTLANDIA VAGRANS (Goode & Bean).

Head 4⅖; depth 5¼. D. V–I, 7; A. I, 14 to I, 17; scales 43–6 to 48–7. First dorsal very small, its insertion over front of anal, midway between base of caudal and posterior angle of opercle; distance from its front to front of second dorsal ⅔ head. Pectorals slightly shorter than head. Vertical fins with large scales. Scales firm, adherent, their edges crenate or laciniate, feeling very rough to the touch. Scales of head large. Color in life, light greenish above, the lateral band broad, covering 2 half rows of scales, becoming narrow posteriorly; sides and belly silvery; tip of snout and of lower jaw yellow, soiled with blackish; each scale of back with 1 to 3 dark points, these forming about 5 conspicuous streaks as seen from above; caudal yellow, with dark punctulations, its margin dusky; dorsal and pectorals somewhat dusky, lower fins white; the anal with dark points at base. Length 4 inches. Coast of Gulf of Mexico, Florida to Texas; very abundant in schools along the sandy beaches. (*vagrans*, wandering.)

*Chirostoma vagrans*, Goode & Bean, Proc. U. S. Nat. Mus., 1879, 148, Pensacola, Florida. (Type, No. 22848. Coll. Stearns.)

*Menidia vagrans*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 267; Jordan & Gilbert, Synopsis, 407, 1883.

### 1159. KIRTLANDIA MARTINICA (Cuvier & Valenciennes).

Head 4⅘; depth 5½; dorsal V–I, 7; anal I, 21; scales 43. Eye large, as long as snout, 3⅕ in head. Teeth rather strong. Scales strongly laciniate. Spinous dorsal opposite front of the anal. Soft dorsal and anal naked (possibly scaly in life?). Pectorals long, extending past base of ventrals. This species is very close to *Kirtlandia laciniata* (Swain) and may prove to be the same. Martinique. Known only from the original types.

*Atherina martinica*, Cuvier & Valenciennes, Hist. Nat. Poiss., x, 459, 1835, Martinique. (Coll. Plée.)

*Menidia martinica*, Jordan, Proc. U. S. Nat. Mus., 1886, 530; redescription of type.

### 1160. KIRTLANDIA LACINIATA (Swain).

(Silverfish.)

Head 4¾; depth 5½; eye large, 3⅓, a little longer than snout; dorsal IV–I, 7 or 8; anal I, 19 to 21; scales 50–7, firm, their edges strongly crenate, those on the back laciniate. Upper jaw the longer. Teeth short, even, forming a narrow villiform band. First dorsal very feeble, over the beginning of the anal, rather nearer tip of caudal than snout; distance from first to second dorsal ⅔ length of head; pectorals reaching ventrals, nearly as long as head; ventrals falling far short of the base of the first dorsal; second dorsal very short. Soft dorsal and anal scaly. Clear translucent greenish above; back with two or more rather irregular series of minute black dots, usually not more than one on each scale; snout and lower jaw dusky; sides with a well-defined silvery band, ⅔ diameter of eye, covering third row of scales, not bounded above by a dark line, but the entire band dusted with dark points; a few minute dots on base of anal; caudal dusky. Virginia to South Carolina; rather common, replacing northward the closely allied *vagrans*, with which it may be found to intergrade. (*laciniatus*, gashed.)

*Menidia vagrans laciniata*, Swain MS. in Jordan & Gilbert, Synopsis, 908, 1883, Beaufort, North Carolina; (Coll. Jordan & Gilbert); Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 589, (April 25, 1883).

## 356. MENIDIA (Bonaparte) Jordan & Gilbert.

(SILVERSIDES.)

*Menidia*, BONAPARTE, Fauna Italica, about 1836, (no type indicated, *menidia* doubtless intended).
*Argyrea*, DE KAY, New York Fauna: Fishes, 141, 1842, (*notata*; name preoccupied).
*Menidia*, JORDAN & GILBERT, Synopsis Fish. N. A., 407, 1883, (*menidia*).

Body elongate, more or less compressed. Head oblong, compressed; belly before ventrals more or less rounded in section, not compressed to an edge. Mouth small, the gape curved, very oblique, usually not reaching the eye; lower jaw short and weak; maxillary slipping entirely under preorbital; jaws each with a band of simple, usually villiform teeth. Premaxillaries very freely protractile, their spines comparatively long, nearly equal to the eye, extending backward beneath a fold of skin which connects the bases of the maxillaries; posterior part of premaxillaries broad. No teeth on vomer or palatines. Both dorsals short, the usual radial formula being D. V–I, 8; first dorsal usually but not always in front of anal; soft dorsal and anal scaleless. Scales rather large, entire. Species numerous, probably all American, all of moderate or small size, some of them entering or inhabiting fresh waters. (*Menidia*, an old name of some small silvery fish, from μήνη, the moon.)

*a.* Scales moderate or large, 36 to 50, those of back entire or slightly crenate; soft dorsal and anal mostly scaleless; teeth moderate.

*b.* Anal rays I, 15 to 18, rarely I, 19; belly very broad, not at all compressed.

*c.* Scales 38 or 39. Origin of spinous dorsal just before vent and midway between tip of snout and base of caudal.

*d.* Snout longer than eye, about 2¾ in head; body deep, the depth 5 in length; soft dorsal I, 8 or 9. PENINSULÆ, 1161.

*dd.* Snout shorter than eye, about 3¼ in head; body slender, the depth 5¼ to 7 in length; soft dorsal usually I, 10. GRACILIS, 1162.

*cc.* Scales 47. Origin of spinous dorsal nearer base of caudal than tip of snout. AUDENS, 1163.

*bb.* Anal rays I, 22 to 24.

*e.* Scales 45 to 48. Body slender, depth 5½ to 6 in length.

*f.* Dorsal spines 6; scales 48; head 4⅔. GILBERTI, 1164.

*ff.* Dorsal spines 4; scales 45 or 46.

*g.* Head 4½ in length; dorsal inserted nearer tip of caudal than end of snout. SARDINA, 1165.

*gg.* Head 5 in length; dorsal midway between tip of snout and base of caudal. NOTATA, 1166.

*ee.* Scales 36 to 40; spinous dorsal inserted over front of anal; pectorals rather long.

*h.* Body rather stout, teeth stronger than usual. Front of dorsal nearer base of caudal than tip of snout; belly slightly compressed. MENIDIA, 1167.

*hh.* Spinous dorsal inserted behind front of anal.

*i.* Scales 36. Depth 5 in length; head 4¼. GUATEMALENSIS,* 1168.

*ii.* Scales 41. Pectoral much longer than head; snout short. PACHYLEPIS,* 1169.

*aa.* Scales small, entire, about 56 in longitudinal series; dorsal rays V–I, 9; anal I, 24; body slender, its depth 6⅓; teeth very weak. CLARA, 1170.

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* The character of the scales has not been verified in *pachylepis* and *guatemalensis*. Both species doubtless belong to *Thyrina*.

### 1161. MENIDIA PENINSULÆ (Goode & Bean).

Head 4; depth 5; eye 3 to 3½, about equal to snout or interorbital width. D. IV or V–I, 8 or 9; A. I, 15 to 18; scales 38 to 40–9. Mouth very protractile; lower jaw long, more than ⅓ length of head. Scales large, thin, and smooth, with entire edges. Soft fins scaleless. Origin of spinous dorsal in advance of anal fin, midway between tip of snout and upper base of caudal. Light green; edges of scales with dark dots; lips and top of head dusky; a dusky streak along base of anal; eye silvery; lateral streak narrow, tapering behind; bases of pectoral and caudal bright yellow; fins otherwise nearly plain. Length 4 inches. Florida and Gulf Coast, very abundant in schools along the sandy beaches. Specimens from black water are very dark, the silvery band underlaid by black. (*peninsulæ*, of the peninsula, *i. e.*, Florida.)

*Chirostoma peninsulæ*, GOODE & BEAN, Proc. U. S. Nat. Mus., 1879, 148, Pensacola and Lake Monroe, Florida. (Type, Nos. 21841*a* and 21841*b*. Coll. Stearns; and No. 21870, Baird). JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 266; JORDAN & GILBERT, Synopsis, 407, 1883.

### 1162. MENIDIA GRACILIS (Günther).

D. IV–I, 8; A. I, 19; scales 40–9. The origin of the anterior dorsal fin is opposite the vent, exactly in the middle of the distance between end of snout and base of caudal. The distance between the origins of the two dorsal fins is somewhat more than ½ that between the origin of the posterior and the caudal. The height of the body is contained nine times in the total length, the length of the head five times and a half. The silvery band is narrow, and occupies a portion of the fourth series of scales. Scales with the margin entire. Caudal lobes equal in length; caudal somewhat longer than the pectoral, and rather shorter than the head. Original locality unknown. (Günther.)

We refer to this species a number of specimens collected by Dr. Hugh M. Smith on St. George's Island, Lower Potomac. These specimens are identified by Dr. Smith as *Menidia beryllina*, but they differ from typical examples of the latter from the Potomac River at Washington, in the slenderer body, shorter dorsal, and in the dark dotting on the back. Head 4⅓; depth 6¼ (7½ to 8 in total). D. V–I, 9; A. I, 17; scales 40. Eye very large, longer than snout, 3 in head; snout short and sharp, 2¾, greatest depth of body nearly 2 in distance from nape to first dorsal. First dorsal just before vent, midway between tip of snout and base of caudal. Dark dots on scales of back and sides; lateral band sharply defined. Woods Hole to Albemarle Sound, generally common in brackish waters. (*gracilis*, slender.)

*Atherinichthys gracilis*, GÜNTHER, Cat., III, 405, 1861; no locality given.
*Menidia beryllina*, H. M. SMITH, Bull. U. S. Fish Comm., X, 1890, 70, pl. XX, fig. 2.

Represented in fresh waters of the Potomac River by the deeper-bodied

### 1162a. MENIDIA GRACILIS BERYLLINA (Cope).

Head 4¼ to 4⅓; depth 5 to 5½; eye very large, 3. Dorsal V–I, 10, rarely V–I, 11 or V, I, 9; anal I, 15 to 18, usually I, 16 or 17; scales 38 to 40–8.

Body very slender. Mandible slightly projecting. First dorsal well in advance of second, inserted just before the vent, about midway between base of caudal and tip of snout. Scales entire; fins not scaly. Greatest depth of body 1½ in distance from nape to spinous dorsal. Very pale olive, with a sharply defined silvery band found anteriorly on the lower half of the fourth row of scales and the upper half of the fifth row; toward the middle, opposite the dorsal fins, it is on the central portion of the fourth row and on the margins of the scales of the third and fifth rows, rising toward the tail, where it covers the lower half of third and upper half of fourth rows; back and sides with scarcely any dark dots. Potomac River, near Washington. (*beryllinus*, emerald color.)

*Chirostoma beryllinum*, COPE, Trans. Amer. Phil. Soc., 1866, 403, Potomac River, at Washington.

*Menidia beryllina*, JORDAN & GILBERT, Synopsis, 408, 1883.

### 1163. MENIDIA AUDENS, Hay.

Head 4½; depth 6. D. IV or V–I, 8 or 9; A. I, 17 or 18; scales 45–10. Head rather broad and flat above. Mouth small Eye 3 in head, equal to snout and to interorbital space. Vent a longitudinal slit, its length ⅔ diameter of eye. First dorsal spine inserted immediately above anterior part of anal slit, slightly nearer base of caudal than snout. Pectorals extending to beyond bases of ventrals, their length ⅘ head. Ventrals reaching vent. Interspace between dorsals twice diameter of eye. Top of head covered with large scales. Lateral silvery band on fifth row of scales and edges of fourth and sixth rows; the extreme parts of fifth row not included in it. Scales with entire edges, which are nearly straight, so that each scale is angulated behind. Soft dorsal naked. Color and form of *Menidia notata*; edges of scales somewhat dotted; a dusky streak at base of anal. Length 3 inches. Mississippi River; known only from Memphis and Vicksburg. (*audens*, daring, having gone far from the sea.)

*Menidia audens*, HAY, Bull. U. S. Fish Comm., II, 1882, 64, Memphis, Tennessee, and Vicksburg, Mississippi; (Coll. Hay); JORDAN & GILBERT, Synopsis, 908, 1883.

### 1164. MENIDIA GILBERTI, Jordan & Bollman.

Head 4⅔ to 4⅘; depth 5⅓–5⅔. D. VI–I, 9; A. I, 21 or 22. Scales 4–48 or 49–4. Body rather slender, elongate, compressed, especially below. Head short, its upper surface slightly convex. Snout larger than eye, 3 to 3⅓ in head. Maxillary 1½ in snout; lower jaw included. Eye moderate, 3 to 3½ in head, 1⅙ to 1¼ in interorbital space. Teeth in jaws small, not close-set, none on vomer or palatines. Gill rakers long and slender, about 20 developed below angle. Origin of first dorsal midway between posterior margin of head and base of caudal, its posterior margin opposite front of anal. Its longest spine 4⅕ in head. Insertion of second dorsal midway between base of caudal and fifth scale in front of first dorsal, opposite middle of anal, its longest ray equal to snout. Distance between origin of second dorsal and base of caudal equal to a distance from tip of snout to $\frac{2}{3}$ an eye's diameter beyond upper angle of pectorals. Origin of anal midway between base of caudal and posterior base of pectorals, the base equal to distance from tip of snout to base of pectorals; longest ray equal to snout and eye. Pectorals reaching beyond origin of ventrals, 1$\frac{1}{7}$ to 1$\frac{1}{6}$ in head. Ventrals reaching halfway to vent, 1$\frac{5}{7}$ to 2 in head, their origin midway between front of anal and edge of preopercie. Vertical fins nearly or quite scaleless. Scales large and firm, those above with the edges distinctly crenate. Color greenish, the black rather pale, the scales thickly dusted with brown dots; a narrow vertebral band, which is anteriorly accompanied by a short line on each side; this band is broadest posteriorly; a bluish-silvery lateral band, bordered by dark above; upper parts dotted with black; sides and belly paler than back, the upper two rows of scales below lateral band anteriorly with a few dots; tip of snout, head between eyes, and Λ-shaped area on top of head, dark; from the occipital mark a streak of dots extends to base of pectorals; only a few dots on top of opercles; lower jaw dusky; lining of opercle dark; fins all pale. Panama; numerous specimens, the largest 4$\frac{1}{4}$ inches long, obtained by the *Albatross*. (Named for Dr. Charles Henry Gilbert, who first discovered the species.)

*Menidia gilberti*, JORDAN & BOLLMAN, Proc. U. S. Nat. Mus., 1889, 155, Panama. (Type, No. 41165. Albatross Coll.)

### 1165. MENIDIA SARDINA (Jenkins & Evermann).

(PEZ DEL REY.)

Head 4$\frac{1}{2}$ in length to base of caudal (5 in total); depth 6 (6$\frac{3}{4}$); eye moderate, 3$\frac{1}{2}$ in head, 1$\frac{1}{4}$ in interorbital space. D. IV–I, 9; A. I, 25; scales 6–45–5. Body rather slender, elongate, greatly compressed ventrally. Head short, greatly flattened above; snout a little greater than eye, blunt, with two evident folds or grooves across it; maxillary protractile, very broad, not reaching orbit; cleft of mouth oblique, curved, the lower jaw but slightly included. Teeth in each jaw very small and wide-set, none on vomer or palatines; gill rakers long and slender. First dorsal short and low, its origin a trifle nearer tip of caudal fin than end of snout, entirely in front of origin of anal. Space between first and second dorsals equals the length of both snout and eye. Distance from beginning of second dorsal to base of caudal fin equals that from end of snout to insertion of pectorals, the fin lying over middle of anal; the first rays are highest, their length being a little greater than the diameter of orbit. Origin of anal under anterior part of the interdorsal space, one and one-half times as far from snout as from base of caudal; length of its base about twice that of the second dorsal, and about equal to head; the first rays the longest. Pectorals short, about $\frac{2}{3}$ length of head. Ventrals small, short, inserted much in front of first dorsal and a little nearer snout than base of caudal, their tips not nearly reaching anal. Scales large, cycloid, not very firm. General color pale, each side with a broad plumbeous lateral band, two scales in width, and equaling $\frac{1}{5}$ length of head; the upper third of this band is much the darker;

above the band the scales are sparsely covered with fine dark punctulations; none below the band, and but few upon it; top of head very pale, almost transparent on the interorbital area, but in front and behind thickly set with small dark spots; snout also marked with spots; lower jaw with some spots in front, plain behind; opercles plain; fins all more or less plainly marked with numerous small dark spots. Length 3½ inches. Gulf of California; common. (*sardina*, sardine.)

*Atherina sardina*, Jenkins & Evermann, Proc. U. S. Nat. Mus., 1888, 137, Guaymas, Sonora. (Type, No. 39633. Coll. Jenkins & Evermann.)

### 1166. MENIDIA NOTATA (Mitchill).

(Silverside.)

Head 5; depth 6. D. IV–I, 8; A. I, 23; scales 46–10. Eye large, 3½ in head, about as long as the snout. Scales with entire edges. Jaws equal. First dorsal large, inserted in front of the anal, over the vent, about midway between snout and base of caudal. Distance between dorsals ⅜ length of head. Pectoral scarcely shorter than head, reaching past base of ventrals, which do not reach the vent or the front of the dorsal. Body slenderer and more compressed than in *Menidia menidia*. Teeth* in few series, some of them larger. Transparent green, with a lateral silvery band half the width of the eye; scales above with spots along their edges, so that their outlines are clearly defined; chin speckled. Length 5 inches. Atlantic Coast of United States, chiefly northward; south to Cape May; very abundant. (*notatus*, spotted, marked.)

*Atherina notata*, Mitchill, Trans. Lit. and Phil. Soc. N. Y., I, 1815, 446, New York; Jordan & Gilbert, Synopsis, 407, 1883.

*Atherina viridescens*, Mitchill, Trans. Lit. and Phil. Soc., I, 1815, 447, New York.

*Atherinichthys menidia* and *notata*, Günther, Cat., III, 406, 1861.

### 1167. MENIDIA MENIDIA (Linnæus).

Head 4⅖; depth 5; eye 3⅓. D. IV–I, 9; A. I, 22 or 23; scales 39 or 40–8, all entire. Cleft of mouth reaching to nearly opposite eye. Jaws equal. Teeth not forming a close band, those of the outer series much enlarged, a pair of small canines at symphysis. First dorsal inserted over the front of the anal, nearer the base of the caudal than the snout. Soft dorsal and anal scaleless. Pectoral as long as the head, reaching well past root of ventrals, which reach the vent. Greenish yellow on back, very thickly covered with fine dots, as are also the snout and lower jaw; lateral streak very narrow, bordered above with a conspicuous greenish-black line; the stripe about as wide as pupil, covering the middle of the fourth series of scales; caudal conspicuously light yellow; dorsal and pectoral fins less so; base of anal dusky. Length 3 inches. Cape Hatteras to Florida, common on the South Atlantic Coast. (*Menidia*, an old name of some small, silvery fish, from μήν, the moon.)

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* First superior pharyngeal without teeth; second with teeth; third and fourth coossified, with teeth.—*E. C. Starks.*

*Atherina menidia*, LINNÆUS, Syst. Naturæ, Ed. XII, 519, 1766, Charleston.
*Atherina bosci*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., x, 465, 1835, Charleston.
*Menidia dentex*, GOODE & BEAN, Proc. U. S. Nat. Mus., 1882, 429, St. John's River. (Type, No. 18051. Coll. Baird.)
*Menidia brasiliensis*, JORDAN & GILBERT, Synopsis, 408, 1883; not of authors.

### 1168. MENIDIA GUATEMALENSIS (Günther).

Head 4¼; depth 5. D. IV–I, 9; A. I, 22; scales 36–7. Anterior dorsal fin very small, inserted behind the vertical from front of anal fin. Silvery band on the third upper series of scales; lower caudal lobe rather longer than upper. Lakes of Guatemala. (Günther); not seen by us.

*Atherinichthys guatemalensis*, GÜNTHER, Proc. Zoöl. Soc., 1864, 151, Lakes of Huamuchal, Guatemala; GÜNTHER, Fishes Central America, 443, 1869.

### 1169. MENIDIA PACHYLEPIS (Günther).

Head 5½; depth 5½. D. IV–I, 6 to 8; A. I, 20 to 21; scales 41–7. The snout is short, not longer than the diameter of eye, and the cleft of the mouth does not extend backward to below the anterior margin of the eye. The anterior dorsal is composed of short, feeble spines, and its origin is opposite to the fourth or fifth anal ray. The pectoral fin is much longer than the head. The silvery streak occupies the adjoining halves of the third and fourth series of scales. Panama. (Günther); not seen by us. (παχύς, thick; λεπίς, scale.)

*Atherinichthys pachylepis*, GÜNTHER, Proc. Zoöl. Soc., 1864, 25, Panama; GÜNTHER, Fishes Central America, 443, 1869.

### 1170. MENIDIA CLARA, Evermann & Jenkins.

Head 4⅕; depth $6\frac{3}{10}$; eye 3. D. V–I, 9; A. 25; scales 56–11. Body slender, general form that of *Menidia sardina*; teeth very feeble; eye large, equal to width of interorbital space; distance between dorsal fins less than that from tip of snout to posterior rim of orbit. Dorsal and anal scaleless. Origin of first dorsal nearer tip of caudal than snout; pectorals ¾ length of head. Scales small and persistent, with entire edges. General color that of *M. sardina*, the lateral band plumbeous above and silvery below. Length 3 inches. Gulf of California; rather rare; approaches *Leuresthes* in the small scales and feeble dentition. (*clarus*, clear.)

*Menidia clara*, EVERMANN & JENKINS, Proc. U. S. Nat. Mus., 1891, 136, Guaymas, Sonora. (Type, No. 43237. Coll. Evermann & Jenkins.)

## 357. LEURESTHES, Jordan & Gilbert.

*Leuresthes*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1880, 29, (*tenuis*).

This genus agrees with *Menidia* in every respect, except that the teeth are very weak and caducous or obsolete, and the scales are very small, as in *Basilichthys*,* 67 to 75 in a lengthwise series. Coast of California. (λευρός, smooth; ἐσθίω, to eat; from the toothless jaws.)

*a*. Scales about 67; lateral band not so wide as eye. CRAMERI, 1171.
*aa*. Scales about 75 in longitudinal series; lateral silvery band wider than eye. TENUIS, 1172.

### 1171. LEURESTHES CRAMERI, Jordan & Evermann, new species.

Head $4\frac{4}{5}$; depth $5\frac{1}{5}$; eye $3\frac{3}{4}$; snout $3\frac{1}{2}$. D. V–I, 8; A. I, 21; scales 5–67–6. Body slender, gently rounded above, narrowed below. Scales smooth, firm, closely imbricated, the membranous edge strongly serrate. Mouth moderate, premaxillaries very protractile; maxillary short, not reaching eye. First dorsal over front of anal, much nearer base of caudal than tip of snout, or midway between base of caudal and gill opening. Color hyaline green, with a lateral silvery streak, plumbeous above, narrow, its width $1\frac{1}{3}$ in eye, wider than one row of scales, covering one row and two half rows; body above lateral line covered with small brown specks; pectorals and caudal chiefly blackish; second dorsal with many black specks; anal and ventrals plain. Close to *Leuresthes tenuis*, from which it differs in the larger scales, smaller eye, shorter maxillary, and the much narrower lateral band. Length 5 inches. Ballenas Bay, Lower California, near Cape Abreojos. Several specimens collected by Dr. Charles H. Gilbert, on the *Albatross*. (Named for Frank Cramer, in recognition of his excellent work on the *Scorpænidæ* and *Agonidæ*.) (Type, No. 27, L. S. Jr. Univ. Mus.)

### 1172. LEURESTHES TENUIS (Ayres).

Head $4\frac{1}{2}$; depth 5. D. V–I, 9; A. I, 22; scales 75. Eye equal to snout. Scales small, smooth, and firm, closely imbricated, their edges crenate. Maxillary not reaching to pupil. Premaxillary very protractile, curved, its posterior portion broad. Lower jaw shorter than upper; soft dorsal and anal scaleless. First dorsal fin over front of anal, much nearer base of caudal than snout. Clear hyaline green, with the lateral silvery streak very distinct bluish, wider than eye, on $1\frac{1}{2}$ rows of scales; edges of scales above bordered by dark points. Length 5 inches. Coast of California from San Francisco to San Diego; abundant in San Diego Bay; too small to be of much use as food. (*tenuis*, slender.)

*Atherinopsis tenuis*, AYRES, Proc. Cal. Ac. Nat. Sci., 1860, 76, San Francisco.
*Leuresthes tenuis*, JORDAN & GILBERT, Synopsis, 405, 1883.

## 358. EURYSTOLE, Jordan & Evermann.

*Eurystole*, JORDAN & EVERMANN, new genus, (*eriarcha*).

This group differs from *Menidia* chiefly in the very long anal fin; the spinous dorsal is very small, the scales smooth, the breast not compressed, the pectorals short, and the head short and deep; the mouth is formed as in *Menidia*, but the jaws are shorter and the opercles are truncated behind. One species known. (*εὐρύς*, broad; *στολή*, stole, the silvery band being very wide.)

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* *Basilichthys*, Girard, the characteristic genus of the coast of Chili, differs from *Menidia* in the very small scales (75 to 105). Some of the species reach a large size and are valued as food. The teeth in *Basilichthys* are well developed.

### 1173. EURYSTOLE ERIARCHA (Jordan & Gilbert).

Head 5; depth 5; snout short, 3½ in head; eye large, 2¾ in head. Dorsal IV–I, 11 or 12; anal I, 27; scales about 48–9.* Body short, deep, much compressed; head short, deep, about ¼ longer than deep, rather broad above; opercles truncate behind, the interorbital space about equal to eye. Mouth very small, terminal, very oblique, with curved cleft as in *Menidia*, the premaxillary very short, wide behind, with curved edge, slipping under the narrower maxillary; the premaxillary protractile but not much movable; jaws subequal, the lower slightly included. Maxillary scarcely as long as eye, not quite reaching front of eye. Teeth rather large, hooked backward. Gill rakers numerous, long and slender. Scales smooth, caducous, not easily counted, 21 before dorsal. Pectoral moderate, not falcate, inserted high, 1⅕ in head, 6 in body, reaching to the middle of the small ventral. Belly not especially compressed; not cultrate. First dorsal very small, slightly nearer snout than base of tail, over first ray of anal; last ray of dorsal much before last of anal. Anal very long, somewhat elevated in front, its base 3 in body. Soft dorsal and anal scaleless. Color translucent green, very pale; back, lips, and base of vertical fins faintly dotted; lateral band very broad and highly silvery, ⅜ as broad as eye; lower fins pale; air bladder not visible through the flesh. Length 2¾ inches; two specimens known, both from Mazatlan, the above description from the second example. (*ἐρι-*, an intensive particle; *ἀρχός*, *anus*, from the long anal fin.)

*Atherinella eriarcha*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1881, 348, Mazatlan. (Type, No. 29243. Coll. Gilbert.)

## 359. THYRINA, Jordan & Culver.

*Thyrina*, Jordan & Culver, Report Fishes Sinaloa, MS., 1895, (*evermanni*).

This genus differs from *Atherinella* chiefly in possessing perfectly smooth scales. The translucent air bladder shows through the skin; the pectoral is falcate, longer than head; anal very long, the small first dorsal inserted behind its front; belly compressed to a bluntish edge. Some of these characters have not been verified in *pachylepis* and *guatemalensis*, which may belong here rather than in *Menidia*. Two species known. (*θύρις*, a window; from the translucent air bladder, which shows through the skin.)

*a.* Anal rays about I, 24, the base of the fin 2¾ in body; pectoral 3½ in body, its posterior margin concave; ventrals pale. EVERMANNI, 1174.

*aa.* Anal rays I, 21, the base of the fin 3 in body; pectoral 4¼ in body, its posterior margin scarcely concave; ventrals black. CRYSTALLINA, 1175.

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*Not to be exactly counted; the number (36–7) stated in our original description was an error. The scales can not be accurately counted, but there are over 40 at least.

### 1174. THYRINA EVERMANNI, Jordan & Culver.

Head $4\frac{3}{4}$; depth $4\frac{2}{3}$ to 5; dorsal IV–I, 7; anal I, 23 to I, 25; scales 36–9; eye $2\frac{2}{3}$ in head; snout $3\frac{2}{5}$ in head; maxillary $3\frac{2}{5}$ in head; lower jaw $2\frac{2}{3}$ in head; pectoral $\frac{1}{4}$ longer than head, $3\frac{1}{2}$ in body; caudal slightly longer than head; interorbital space broad, nearly equal to eye. Body much compressed, the belly sharp-edged, concave on each side below pectorals as if pinched together between the fingers, the ribs reaching the edge, the scales passing around it; the edge almost carinate. Back narrow. Scales smooth, none on dorsal or anal. Mouth small, terminal, the short jaws curved, the structure precisely as in *Menidia*; the teeth moderate, curved, those in the upper jaw longer; opercles oblique behind, not vertically truncate. Gill rakers numerous, long and slender; pectorals very long and falcate, reaching to front of anal and beyond tips of short ventrals, their posterior margin concave; spinous dorsal small, inserted midway between edge of preopercle and base of caudal, about over sixth ray of anal; last ray of dorsal considerably before last of anal; base of anal $1\frac{2}{3}$ times length of head, $2\frac{3}{4}$ in body. Color light green, much dotted above, translucent below; a black streak of dots along base of anal; some on sides of head; median line of back dusky; fins all pale; no black on spinous dorsal, ventral, or pectoral; lateral stripe $\frac{2}{3}$ width of eye, underlaid by black; a large, transparent, window-like space above front of anal, marking the posterior portion of the air bladder. Length $2\frac{1}{2}$ to 3 inches; rather common in the estuary at Mazatlan. (Named for Dr. Barton Warren Evermann.)

*Atherinella evermanni*, JORDAN & CULVER, MS., Rept. Fishes Sinaloa, 1895, Mazatlan. (Type, No. 2688, L. S. Jr. Univ. Mus. Cotype, No. 47494, U. S. Nat. Mus. Coll. Hopkins Expedition.)

### 1175. THYRINA CRYSTALLINA, Jordan & Culver.

Head $4\frac{3}{4}$; depth $4\frac{1}{2}$ to 5. Dorsal IV–I, 8; anal I, 21; scales 40–11; pectoral $\frac{1}{5}$ longer than head, $4\frac{1}{4}$ in body; anal base more than half longer than head, 3 in body; eye $2\frac{3}{4}$ in head; snout $3\frac{1}{4}$; maxillary $2\frac{2}{3}$; lower jaw $2\frac{1}{2}$. Body rather deep and compressed; snout shortish; opercle shortish, rounded behind; mouth small, the upper jaw very protractile, the premaxillary strongly curved; jaws equal; teeth rather strong, the outer curved, those in upper jaw largest; eyes very large, silvery; breast compressed, as in *Thyrina evermanni*, but less sharp at edge, appearing as if pinched between thumb and finger; pectoral long, pointed, not truly falcate, reaching more or less past the middle of the short ventrals, its posterior margin not concave, the middle rays considerably more than half length of upper rays; dorsal and anal naked; gill rakers numerous, long and slender. First dorsal small, behind front of the long anal, midway between gill opening and base of caudal; first ray of soft dorsal over about fourth of anal; last rays of soft dorsal considerably before last of anal. Caudal lunate, the lower lobe the longer and broader, as long as head. Color translucent green, with considerable dusky dottings, no yellow; fins dotted; ventrals black, as are lobes of second dorsal and anal; silvery stripe narrow, underlaid by dusky, its width little more than half the eye; first dorsal and base of anal dusky; outlines of air bladder evident through the translucent sides of body, but less so than in *Thyrina evermanni*. Length 3¼ inches. Rio Presidio, near Mazatlan, Sinaloa, in fresh water; very common; the longest specimen 3¼ inches long. (*crystallinus*, crystalline, from the window-like appearance of the air bladder through the translucent muscles.)

*Atherinella crystallina*, Jordan & Culver, Fishes Sinaloa, MS., 1895, Rio Presidio, below Presidio, Sinaloa. (Type, No. 2685, L. S. Jr. Univ. Mus. Cotype, No. 47440, U. S. Nat. Mus. Coll. Hopkins Expedition.)

## 360. ATHERINELLA, Steindachner.

*Atherinella*, Steindachner, Ichth. Beiträge, ii, 35, 1875, (*panamensis*).

Body elongate, with the abdominal edge compressed into a keel. Cleft of mouth very oblique; teeth hooked; scales strongly ctenoid. Upper jaw protractile; pectoral very long and falcate. First dorsal small, inserted behind front of long anal. Eastern Pacific. (Name a diminutive of *Atherina*.)

### 1176. ATHERINELLA PANAMENSIS, Steindachner.

Head 4⅔; depth 4⅔. D. III-1, 7; A. I, 21; scales 37 or 38–7½; eye large, 3; snout 3. The broad flat interorbital space 2½ in head. Profile straight from snout to second dorsal. Ventral convex from base of lower jaw to end of long anal, edge of abdomen forming a sharp keel. Lower jaw oblique; premaxillary protractile; maxillary concealed by preorbital when mouth is closed. Teeth in several rows, those of two outer rows thickened at base and strongly incurved at tips. Pectoral very strongly developed, much longer than head, falcate, as in *Pelecus cultratus*, which this species strongly resembles. Upper pectoral ray longest, 2½ in body, others rapidly shortening; ventrals short, nearer tip of lower jaw than base of caudal. Spinous dorsal short and weak, inserted over tenth anal ray; soft dorsal extending farther back than anal; lower caudal lobe longest. Scales strongly ctenoid, those above lateral line longest. A silver-gray lateral band dotted with black. Panama. (Steindachner.) Known from one specimen 5½ inches long.

*Atherinella panamensus*, Steindachner, Ichth. Beit., ii, 35, 1875, Panama.

## 361. LABIDESTHES, Cope.

*Labidesthes*, Cope, Proc. Amer. Phil. Soc. Phila., 1870, 455, (*sicculum*).

This genus differs from *Menidia* chiefly in the prolongation of the jaws, both of which are produced into a short depressed beak. The scales are small, as in *Leuresthes* and *Basilichthys*, their edges entire. (*λαβίς*, a pair of forceps; *ἐσϑίω*,to eat.)

### 1177. LABIDESTHES SICCULUS (Cope).

(Brook Silverside; Skipjack.)

Head 4½; depth 6; eye 3½. D. IV-I, 11; A. I, 23; scales 75. Body elongate, very slender, compressed. Head long, flattened above, narrow below. Snout slender, conic. Premaxillaries broad posteriorly, very protractile, produced forward, the snout longer than the large eye. Edge of upper jaw strongly concave. Teeth very slender, mostly in one series, forming a narrow band in front. Scales small, thin, with entire edges. Spinous dorsal very small; soft dorsal short. Anal fin long; caudal forked; pectorals moderate. First dorsal inserted somewhat behind the vent. Pale olive green, translucent; lateral silvery band very distinct, scarcely broader than pupil, bounded above by a dark line; back dotted with black. In the black waters of the lowland swamps the silvery is underlaid by black. Length 3½ inches. Ponds and sluggish streams; Lake Ontario and southern Michigan to Iowa, Florida, and Texas; locally abundant; a very graceful little fish, widely distributed, confined to fresh waters. (*siccus*, dried; found in half-dry pools.)

*Chirostoma sicculum*, COPE, Proc. Ac. Nat. Sci. Phila., 1865, 81, Crosse Isle, Detroit River. (Coll. Professor Fox.)

*Labidesthes sicculus*, COPE, Proc. Amer. Phil. Soc. Phila., 1870, 40; JORDAN & GILBERT, Synopsis, 406, 1883.

## 362. ATHERINOPSIS, Girard.

(PESCADO DEL REY.)

*Atherinopsis*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 134, (*californiensis*).

This genus differs from *Basilichthys* in the nonprotractility of the upper jaw. The spines of the premaxillaries are very short, much shorter than the eye, and they are covered by a skin which is continuous with that of the forehead, being only capable of such motion as is permitted by the extension of a fold of skin between the jaws and the frontal region. Scales small. One species, reaching a considerable size, and having importance as a food-fish. (*Atherina*; ὄψις, appearance.)

### 1178. ATHERINOPSIS CALIFORNIENSIS, Girard.

("CALIFORNIA SMELT;" PESCADO DEL REY; PEIXE REY; PESCE-RE.)

Head 4¾; depth 5. D. IX–I, 12; A. I, 23; scales 77–13. Eye small, 5 in head. Body elongate, little compressed. Maxillary narrow, not reaching to the eye, not slipping under the preorbital. Jaws even; teeth small, pointed, in narrow bands; inner series of upper jaw enlarged. Gill rakers very long and slender. Scales crenate, somewhat rough, but not laciniate. First dorsal large, inserted in front of anal nearer base than snout; second dorsal inserted in front of middle of anal, which has a scaly sheath. Pectorals nearly as long as head, not reaching to ventrals, the latter halfway to vent. Vertebræ about 45. Translucent greenish, a burnished lateral stripe which is rather plumbeous than silvery, some yellow on the opercles. Length 18 inches. Coast of California, from Cape Mendocino to San Diego; very abundant in schools near the shore; a food-fish of considerable importance, with white flesh of fine texture; wrongly known as "Smelt" to English-speaking people in California.

*Atherinopsis californiensis*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 134, San Francisco, Cal. (Coll. Dr. Heermann.)

*Atherinichthys californiensis*, GÜNTHER, Cat., III, 406, 1861; JORDAN & GILBERT, Synopsis, 409, 1883.

*Atherina storeri* (AYRES) GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 136, San Francisco.

## 363. ATHERINOPS, Steindachner.

(PESCADILLOS DEL REY.)

*Atherinops*, STEINDACHNER, Ichth. Beiträge, III, 61, 1875, (*affinis*).

Teeth incisor-like, bifid or branched, arranged in a single row in each jaw. Otherwise as in *Atherinopsis*. Three species known, from California and Mexico. These differ from the other *Atherinidæ* in being chiefly herbivorous as the dentition would indicate. (*Atherina*; ὤψ, appearance.)

*a.* Teeth Y-shaped, the inner fork little if any shorter than the outer.
 *b.* Scales 62 to 68. Dorsal V–I, 11; anal I, 22; spinous dorsal much in front of anal. INSULARUM, 1179.
 *bb.* Scales 52 to 56. Dorsal VI–I, 11; anal I, 22. Spinous dorsal over vent. AFFINIS, 1180.
*aa.* Teeth scarcely Y-shaped, the inner prong forming a short lateral branch on the main stem. Scales 46. Dorsal VII–I, 10; anal I, 22; spinous dorsal in front of vent. Pectorals longer than head. REGIS, 1181.

### 1179. ATHERINOPS INSULARUM, Gilbert.

Closely allied to *Atherinops affinis*, differing in the darker color, the slenderer form, the much smaller scales, and the shorter spinous dorsal, which is inserted farther forward. Scales 62 to 68 (52 to 56 in *affinis*); 5 scales between upper edge of silvery band and front of spinous dorsal (4 in *affinis*). Front of dorsal much nearer tip of snout than is front of anal, the distance between base of last dorsal spine and front of soft dorsal greater than length of base of soft dorsal (much less than length of dorsal in *affinis*). Spinous dorsal constantly with 5 spines (6 or 7 in *affinis*). Otherwise, in fins, dentition, and general proportions as in *affinis*. As in *affinis*, the inner fork of teeth is occasionally shorter than the outer, approaching the case of *Atherinops regis*, where this is the rule. Very abundant at San Clemente and San Nicolas Islands of the Santa Barbara Group, and farther south at Guadalupe Island; not yet found on the shores of the mainland. *A. affinis* is not known from these islands. (*insularum*, of the islands.)

*Atherina insularum*, GILBERT, Proc. U. S. Nat. Mus., 1891, 549, San Clemente; San Nicolas; Guadalupe Island. (Coll. Gilbert.)

### 1180. ATHERINOPS AFFINIS (Ayres).

(LITTLE "SMELT;" PESCADILLO DEL REY.)

Head 5; depth 4½. D. VI–I, 11; A. I, 22; scales 52 to 56. Maxillary not reaching pupil. Lower jaw slightly shorter than upper. Teeth* close-set, incisor-like, Y-shaped, the forks divergent, the inner fork often a little shorter than the other; teeth in lower jaw largest and most movable. Eye large, not longer than snout. Spinous dorsal moderate, inserted over the vent, its origin midway between posterior angle of opercle and base of caudal. Pectoral about as long as the head, reaching ventrals, the ventrals not to vent. Body stouter than in related species. Scales firm, crenate. Peritoneum dark; herbivorous. Clear hyaline green, a silvery lateral band, 1½ scales wide, narrower than eye, bordered above by a purplish line. Back and sides thickly punctate. Iris and opercles with bright yellow. Length a foot. Coast of California in sandy bays in schools, with *Atherinopsis californiensis*, and equally abundant; also an excellent food-fish, but smaller and therefore of less importance. (*affinis*, related.)

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* First superior pharyngeal with teeth; second, third, and fourth coossified, with teeth.—*E. C. Starks.*

*Atherinopsis affinis*, AYRES, Proc. Cal. Ac. Nat. Sci., 1860, 73, San Francisco.
*Atherinops affinis*, JORDAN & GILBERT, Synopsis, 409, 1883.

### 1181. ATHERINOPS REGIS, Jenkins & Evermann.

(PEZ DEL REY.)

Head 4½; depth 4½. D. VII–11; A. I, 22; scales 46–15; eye large, equaling snout, 3⅝ in head. Maxillary not reaching pupil, lower jaw shorter than upper. Teeth in a single series, close-set, incisor-like, weak, each with a short lateral branch on the main stem, not Y-shaped; tips brown. Gill rakers about 19 on lower limb of anterior arch, about 30 on lower limbs of succeeding arches, not strong, equaling diameter of pupil. Origin of spinous dorsal in front of vent, its distance from tip of snout being but little more than half length of body, the origin of the first to the origin of the second dorsal less than ⅕ length of body. The origin of first dorsal is much nearer the angle of the opercle than to base of caudal. The pectorals are longer than head by ¼ the length of the head, reaching to the middle of ventrals. Ventrals about reaching vent, nearly 2 in head. Scales firm, large; pores developed on scales on various parts of the body; 4 rows on the cheeks. Peritoneum black. Color, in alcohol, pale, darker above the lateral band, the scales in this region having fine punctulations, a silvery band slightly more than one scale wide, ⅗ the diameter of the eye, the upper third bordered by a dark line. This species is allied to *Atherinops affinis*, Ayres, from which it differs in the longer pectorals, larger scales, and in the position of the spinous dorsal, which in this species is much nearer the head. Gulf of California; a common food-fish. (*regis*, del rey, of the king.)

*Atherinops regis*, JENKINS & EVERMANN, Proc. U. S. Nat. Mus., 1888, 138, Bay of Guaymas. (Type, No. 39632. Coll. Jenkins & Evermann.)

## Family CVII. MUGILIDÆ.*

(THE MULLETS.)

Body oblong, more or less compressed, covered with rather large cycloid scales; no lateral line, but the furrows often deepened on the middle of each scale so as to form lateral streaks. Mouth small, the jaws with

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*For a detailed account of the American marine *Mugilidæ*, see Jordan & Swain, Proc. U. S. Nat. Mus., 1884, 261.

small teeth, or none, the teeth various in form; premaxillaries protractile. Gill openings wide, the membranes separate, free from the isthmus. Branchiostegals 5 or 6. Gill rakers long and slender. Gills 4, a slit behind fourth. Pseudobranchiæ large. Two short dorsal fins, well separated, the anterior with 4 stiff spines, the last one of which is much shorter than the others; second dorsal longer than the first, similar to anal; anal spines 2 or 3, graduated; ventral fins abdominal, not far back, composed of 1 spine and 5 rays; caudal forked. Air bladder large, simple. Intestinal canal long. Peritoneum usually black. Vertebræ 24. Genera 8 or 10; species about 100, inhabiting the fresh waters and coasts of warm regions, feeding on organic matter contained in mud. "In the genus *Mugil*, a considerable indigestible portion of the latter is swallowed, and in order to prevent larger bodies from passing into the stomach, or substances from passing through the gill openings, these fishes have the organs of the pharynx modified into a filtering apparatus. They take in a quantity of sand or mud, and after having worked it for some time between the pharyngeal bones, they eject the roughest and indigestible portion of it. The upper pharyngeals have a rather irregular form; they are slightly arched, the convexity being directed toward the pharyngeal cavity, tapering anteriorly, and broad posteriorly. They are coated with a thick, soft membrane, which reaches far beyond the margin of the bone, and is studded all over with minute horny cilia. Each branchial arch is provided with a series of long gill rakers, which are laterally bent downward, each series closely fitting to the sides of the adjoining arch; they constitute together a sieve admirably adapted to permit a transit for the water, retaining at the same time every solid substance in the cavity of the pharynx." (Günther.) (*Mugilidæ*, Günther, III, Cat., 409–467, 1861.)

MUGILINÆ:

*a.* Stomach muscular, gizzard-like; teeth slender, usually having the form of cilia; lower jaw angular in front; species chiefly marine.
  *b.* Anal spines 3; teeth ciliiform, flexible.
    *c.* Orbit with a well-developed adipose eyelid, covering part of the iris; cilia in one or few series, slender; cleft of mouth chiefly anterior. MUGIL, 364.
    *cc.* Orbit without distinct adipose eyelid.
      *d.* Cleft of mouth lateral; lower jaw narrow; upper jaw very thick and very protractile; cilia broad, in many series, pavement-like. CHÆNOMUGIL, 365.
  *bb.* Anal spines 2, the first soft ray simple but articulate; teeth distinct, in a few series, scarcely ciliiform, often obsolete in the lower jaw; lips thin; no adipose eyelid; preorbital serrate. QUERIMANA, 366.

AGONOSTOMINÆ:

*aa.* Stomach not gizzard-like; teeth not ciliiform; lower jaw not angular in front; cleft of mouth lateral; fresh-water species, inhabiting chiefly mountain torrents in the tropics.
  *e.* Teeth in villiform bands.
    *f.* Anal spines 2; teeth in bands on jaws and vomer; lower jaw without lamelliform folds. AGONOSTOMUS, 367.
  *ee.* Teeth coarse, broad, truncate incisors, with their free edges serrate; smaller teeth on vomer; none on palatines; head heavy, the blunt, tumid snout overhanging the small, inferior mouth; lower jaw forming a sharp soft edge. JOTURUS, 368.

## 364. MUGIL (Artedi) Linnæus.

(MULLETS.)

*Mugil* (ARTEDI) LINNÆUS, Syst. Nat., Ed. x, 1758, 316, (*cephalus*).

Body oblong, somewhat compressed, covered with large scales. Head large, convex, scaled above and on sides. Mouth small, subinferior, the lower jaw angulated. Jaws with one or a few series of short, flexible, ciliiform teeth; no teeth on vomer or palatines. Eye large, with a large adipose eyelid, which is little developed in the young. Stomach muscular, like the gizzard of a fowl. Species very numerous, living on mud and running in great schools along the shores and in brackish lagoons of all warm regions. We here exclude from *Mugil* the Old World group, *Liza* (type *Mugil capito*), similar in habit to *Mugil* but lacking the adipose eyelid. (*Mugil*, the Mullet, from *mulgeo*, to suck.)

*a.* Soft dorsal and anal fins almost naked; anal rays III, 8, rarely III, 7; sides with dark longitudinal stripes along the rows of scales; caudal deeply forked; size large.
  *b.* Scales about 33 in longitudinal series; depth about 4½ in length to base of caudal; teeth very minute; distance from tip of pectoral to front of dorsal about $\frac{2}{7}$ the length of the pectoral; lips rather thin. BRASILIENSIS, 1182.
  *bb.* Scales about 41 in a longitudinal series; depth about 4 in length to base of caudal; teeth close-set, rather small; distance of tip of pectoral from front of dorsal about $\frac{2}{9}$ the length of pectoral. CEPHALUS, 1183.
*aa.* Soft dorsal and anal fins scaled; sides without dark stripes along the rows of scales; caudal less deeply forked; size smaller.
  *c.* Anal rays III, 9; scales 35 to 45 in a longitudinal series.
    *d.* Scales 42 to 45 in longitudinal series; teeth small.
      *e.* Head small, 4½ in length. INCILIS, 1184.
      *ee.* Head large, 3¾ in length. THOBURNI, 1185.
    *dd.* Scales 35 to 38 in longitudinal series.
      *f.* Pectoral not nearly reaching origin of dorsal, the distance from its tip to front of dorsal being in the adult ⅙ length of pectoral; teeth close-set, rather small, (but distinctly visible without a lens; scales 38 or 39 in longitudinal series; dorsal less falcate. CUREMA, 1186.
      *ff.* Pectoral nearly reaching origin of dorsal.
        *g.* Teeth rather wide-set, very small, mostly uniserial, scarcely visible in adult without a lens; larger in the young.
          *h.* Scales 38; bare space between dentary bones very large. HOSPES, 1187.
          *hh.* Scales 35 or 36 in longitudinal series; bare space between dentary bones small. GAIMARDIANUS, 1188.
        *gg.* Teeth large, in many series above; fins deeply falcate; 37 scales in longitudinal series. SETOSUS, 1189.
  *cc.* Anal rays III, 8; scales very large, about 33 in a longitudinal series; teeth wide-set, larger than in any other species except *setosus*, about as long as the nostril; upper lip thick; pectoral not nearly reaching front of dorsal; size small. TRICHODON, 1190.

### 1182. MUGIL BRASILIENSIS, Agassiz.

(LIZA; LEBRANCHO; QUERIMAN.)

Head 4 in length (5¼ including caudal); depth $4\frac{4}{7}$ ($5\frac{6}{7}$). D. IV–I, 8; A. III, 8; scales 35–12. Body elongate, more slender than in any other American *Mugil*. Snout broad and bluntish, the upper profile almost straight and horizontal (in young examples the anterior profile is about equally oblique above and below). Interorbital space greatly convex, its width 2 in head. Upper lip rather thin. Space at the chin between the mandibulary bones oblanceolate, acutish posteriorly. Preorbital large, almost covering maxillary. Eyes hidden anteriorly and posteriorly by a broad adipose membrane. Teeth very minute. Scales large, those on top of head larger; about 21 large scales between origin of dorsal and tip of snout; soft dorsal and anal almost naked. Margin of soft dorsal very concave, the sixth ray shortest, 3 times in second and longest ray. Anal similar to soft dorsal, but slightly less concave. Caudal deeply forked. Color dusky above, silvery below; a dusky streak along each row of scales, these streaks not so wide as in *Mugil cephalus*. Scales on side and opercle with dark punctulations; ventrals pale yellowish, the fins otherwise dusky. Length 18 inches. Cuba to Patagonia, common in the West Indies and along the coast of Brazil; abundant in the markets of Havana, where it is usually known as *Lebrancho*. It has not yet been noticed in the waters of Florida, although probably occurring there. It is readily distinguished from *Mugil cephalus* and other species with naked dorsal and anal, by its large scales.

*Mugil brasiliensis*, AGASSIZ, Spix, Pisc. Brasil., 234, plate 72, 1829, Atlantic Ocean off Brazil; the types in the museum at Munich; JORDAN & SWAIN, Proc. U. S. Nat. Mus., 1886, 262.

*Mugil liza*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XI, 83, 1836, Brazil; Porto Rico; Maracaibo; Surinam; Martinique.

*Mugil lebranchus*, POEY, Memorias, II, 260, plate 18, fig. 3, 1861, Cuba.

### 1183. MUGIL CEPHALUS, Linnæus.

(COMMON MULLET; STRIPED MULLET; CÉFALO; MACHO; MACHUTO; LISA CABEZUDA.)

Head $4\frac{1}{6}$ ($5\frac{1}{3}$ in total with caudal); depth $3\frac{5}{6}$ (5 in total). D. IV-I, 8; A. III, 8 (very rarely III, 7); scales 41–13. Body rather robust, somewhat compressed, its depth moderate. Snout rather narrow and acutish, its upper profile little less oblique than lower. Interorbital space slightly convex, $2\frac{2}{5}$ in head. Upper lip rather thin. Space at the chin between the mandibulary bones oblanceolate, acutish posteriorly. Preorbital narrow, not nearly covering the maxillary. Eyes hidden anteriorly and posteriorly by a broad adipose membrane. Teeth close-set, rather small, but evident. Scales rather small; about 23 large scales between origin of dorsal and tip of snout; scales on top of head slightly enlarged; soft dorsal and anal with very few scales. First dorsal spine usually a little more than half head, its length subject to some variation. Margin of soft dorsal concave, the seventh ray shortest, $2\frac{1}{2}$ times in length of second or longest ray; anal similar to soft dorsal, but less concave. Pectoral reaching nearly to front of spinous dorsal, its insertion above axis of body.* Caudal deeply forked. Color dark bluish above; sides silvery, with conspicuous dark stripes along each row of scales; pale yellowish below; ventrals yellowish, the other fins more or less dusky. Length 1 to 2 feet. Coasts of southern Europe and northern Africa; Atlantic coast of America, from Cape Cod to Brazil; Pacific coast, in great schools in bays, lagoons, and sheltered waters from Monterey to Chili, everywhere very common; a food-fish of considerable importance, the flesh of fair quality. On renewed comparison of specimens we are still wholly unable to separate *M. albula* from the east coast of North and South America, *M. mexicanus* of southern California, *M. guntheri* from western Mexico, and *M. rammelsbergii* from Peru, from the ordinary European mullet, and so unite all under one head as *Mugil cephalus*. The species has, however, not been recorded from Cuba. (*Cephalus*, Céfalo, an old name from κεφαλή, head.) (Eu.)

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* Not on the median line, as stated by Dr. Günther in his account of *Mugil lineatus*.

*Mugil cephalus*, Linnæus, Systema Naturæ, Ed. x, 316, 1758, Europe; based on Artedi.
*Mugil albula*, Linnæus, Syst. Nat., Ed. xii, 520, 1766, Charleston. (Coll. Dr. Garden.)
*Mugil tang*, Bloch, Ichthyologia, plate 395, 1794, Africa.
*Mugil plumieri*, Bloch, *l. c.*, plate 396, 1794, St. Vincent; on a drawing by Plumier.
*Mugil lineatus*, Mitchill MS., Cuvier & Valenciennes, Hist. Nat. Poiss., xi, 96, 1836, New York.
*Mugil rammelsbergii*, Tschudi, Fauna Peruana, Ichthy., 20, 1845, Peru.
*Mugil berlandieri*, Girard, U. S. and Mex. Bound. Surv., 20, plate 10, figs. 1 to 4, 1859, St. Joseph's Island, Indianola; Brazos Santiago; Brazos; and Galveston; all on coast of Texas. (Coll. Würdemann, Clark, and Kennerly.)
*Mugil güntheri*, Gill, Proc. Ac. Nat. Sci. Phila., 1863, 169, western coast of Central America; not of Steindachner.
*Mugil mexicanus*, Steindachner, Ichthyol. Beiträge, iii, 59, 1875, Acapulco.
*Mugil albula*, Jordan & Gilbert, Synopsis, 403, 1883.
*Mugil cephalus*, Jordan & Swain, Proc. U. S. Nat. Mus., 1884, 263.

### 1184. MUGIL INCILIS, Hancock.

(Trench Mullet.)

Head 4½; depth 4½. D. IV–I, 8; A. III, 9; scales 42 to 44–15, 23 before the dorsal. Snout moderately broad, scarcely convex, with the lower profile ascending in the same degree as the upper descends; the teeth very small, slender; interorbital space slightly convex, its width 2⅔ in length of head. Upper lip rather thin; the angle made by the two mandibulary bones a right one; the preorbital tapers posteriorly, has the anterior margin finely serrated, and covers the maxillary so that only a very narrow portion of it is visible on the side of the snout. Adipose eyelids large. The space of the chin, between the mandibles and interopercles is elongate cuneiform. Soft dorsal and anal fins scaly. Second dorsal spine slightly longer than the first, and more than half length of head; pectoral short, reaching tenth scale, not quite reaching dorsal; fins scarcely falcate; caudal deeply emarginate. Silvery; axil blackish; sides without dark stripes along the rows of scales. (Günther.) Brackish waters from Rio Chagres to Pará and Bahia; common. (*incilis*, pertaining to a ditch.)

*Mugil incilis*, Hancock, Quart. Journ. Sci., 1830, 127, Guiana; Günther, Fishes Centr. Amer., 1869, Jordan & Swain, Proc. U. S. Nat. Mus., 1884, 266.
*Mugil güntheri*, Steindachner, Ichth. Notizen, i, 12, 1864, British Guiana.

### 1185. MUGIL THOBURNI, Jordan & Starks, new species.

Head 3½ to 3¾; depth 4; dorsal IV–7; anal III, 9; scales 44–15; orbit equal to snout, 4½ in head; uncovered part of eye 8 or 9 in head; interorbital 2½; first dorsal spine 2; soft dorsal and anal equal, the longest ray 2⅓; ventrals 2 in head; pectoral 1⅔. Body moderately elongate; a very gentle curve from tip of snout to dorsal; ventral outline considerably curved, the curve uniform from chin to caudal peduncle. Head large, broadly rounded above; eye moderate, with a large adipose eyelid;

mouth oblique, the maxillary reaching to front of orbit; upper lip rather thick; lower jaw with a knob at the middle which fits into an emargination in the upper, its angle more obtuse than a right angle; space on chin between mandibulary bones, broad in front, acute behind, the subopercles meeting below. Teeth very minute, scarcely appreciable. Preorbital minutely serrated. Pectorals reaching about to middle of ventrals, not to spinous dorsal; spinous dorsal inserted above posterior end of ventrals when fin is depressed; first spine of dorsal the longest; soft dorsal and anal similar, their margins incised; ventrals inserted behind middle of pectoral; soft dorsal and anal scaly, 23 scales before dorsal. Color slaty bluish above, silvery below; sides with rather faint longitudinal bluish stripes which follow the rows of scales, fading out on the belly and running into the darker color on the back; ventrals and anal pale; pectoral and dorsals dusky; a dusky bar at base of pectoral. Pacific Coast of tropical America from Guatemala to Galapagos; the types, two specimens (No. 1607, L. S. Jr. Univ. Mus.), the largest 8 inches long, collected by the *Albatross* in the Galapagos. Close to *Mugil incilis*, the head larger, and with several minor differences. (Named for Dr. Wilbur Wilson Thoburn of Stanford University in recognition of his work on the *Cottidæ*.)

### 1186. MUGIL CUREMA, Cuvier & Valenciennes.

(WHITE MULLET; BLUE-BACK MULLET; LIZA; LISA BLANCA.)

Head $4\frac{1}{3}$; depth $3\frac{5}{6}$. D. IV–I, 8; A. III, 9; scales 38–12. Body moderately elongate, its depth about equaling that of *Mugil cephalus.* Snout rather narrow and pointed, the upper profile not so oblique as lower. Interorbital space slightly convex, $2\frac{4}{9}$ in head. Upper lip rather thick. Space at the chin between the mandibulary bones oblanceolate, acutish posteriorly. Preorbital rather narrow, nearly covering the maxillary posteriorly. Eyes hidden anteriorly and posteriorly by a broad adipose membrane. Teeth thick-set, rather small, but distinctly visible to the naked eye. Scales rather small, about 23 from origin or dorsal to tip of snout; soft dorsal and anal densely scaled. Soft dorsal slightly concave, the seventh and shortest ray $2\frac{1}{3}$ in second or longest ray. Anal similar to soft dorsal. Pectoral falling short of spinous dorsal by a distance equal to $\frac{1}{3}$ its length in adult, sometimes longer in young. Caudal forked. Color dark olive above, with some bluish reflections; silvery below; no dusky streaks along sides; a rather small dark blotch at base of pectoral; spinous and soft dorsal and pectorals pale, with numerous small dark punctulations; caudal pale, yellowish at base, margin of fin blackish; anal and ventrals yellowish; side of head with two yellow blotches. Cape Cod to Brazil; Magdalena Bay to Chili, generally common on both coasts of America, especially in the tropics. A food-fish of importance, entering the sea more freely than does *Mugil cephalus,* which is a bay fish. Length about a foot. (*Curema*, a Portuguese name used by Marcgrave, doubtless corresponding to the Spanish *Queriman.*)

*Mugil curema*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., XI, 87, 1836, Brazil; Martinique; Cuba.

*Mugil petrosus*, Cuvier & Valenciennes, *l. c.*, 89, Brazil; Surinam; Gulf of Mexico; Cuba; Jordan & Swain, Proc. U. S. Nat. Mus., 1884, 268.

*Mugil brasiliensis*, Jordan & Gilbert, Synopsis, 403, 1883; Günther, Cat. III, 431, 1861; not of Agassiz.

### 1187. MUGIL HOSPES, Jordan & Culver.

(Lisita.)

Head 3⅔ to 4; depth 4 to 4⅓. D. IV–8; A. III, 9; scales 38–13; eye 4½ in head; snout 4; maxillary 4. Body a little slenderer and more compressed than in *Mugil curema*, the back considerably arched, the profile gently curved from tip of snout to front of soft dorsal. Eye moderate, with a large adipose eyelid. Head broad, rounded above, the interorbital width 2⅖ in its length. Teeth very small, visible with a lens only. Tip of lower jaw forming a right angle. Bare space between dentary bones club-shaped, much larger than in *Mugil curema*, the subopercles barely meeting below. Pectoral somewhat falcate, unusually long, reaching about to base of third dorsal spine, 1¼ in head, its long axillary scale unusually long, half length of the fin and 2½ in head. First dorsal inserted over middle of body, over middle of length of ventral spine; second dorsal moderate, its edge incised; upper lobe of caudal a little longer than lower, as long as head. Anal rather high; ventrals inserted before middle of pectorals. Dorsal and anal fins scaly. Color much as in *Mugil curema*, rather greener above, sides silvery, with faint traces of longitudinal streaks; fins pale; upper edge of pectoral and end of caudal dusky; a small blackish spot at base of pectoral above; no yellow on head. Length 9 inches. Pacific Coast of Mexico, not rare in Mazatlan Harbor, with *Mugil curema*, from which the long pectoral readily distinguishes it. (*hospes*, a landlord, in allusion to the almost constant presence in the mouth of a small *Oniscid* crustacean similar to that found in the Menhaden.)

*Mugil hospes*, Jordan & Culver, MS., Fishes of Sinaloa, 1895, Mazatlan. (Type, No. 2980, L. S. Jr. Univ. Mus.; cotypes, No. 47446, U. S. Nat. Mus. Coll. Jordan, Culver & Starks.)

### 1188. MUGIL GAIMARDIANUS, Desmarest.

(Red-eye Mullet; Liza Ojo de Perdriz.)

Head 4; depth 3⅗. D. IV–I, 8; A. III, 9; scales 35 or 36–11. Body rather robust, moderately compressed. Snout rather narrow and pointed, upper profile almost as oblique as lower. Interorbital space convex, 2¼ in head. Upper lip rather thick, about as in *Mugil curema*. Space at the chin between the mandibulary bones elliptical, acutish in front and behind, scarcely longer than snout. Preorbital rather narrow, covering about half of the maxillary. Eyes hidden anteriorly and posteriorly by a broad adipose membrane. Teeth rather wide-set, very small, not visible without the aid of a lens. Scales in the adult rather large, evident in the young, about 20 in a line from origin of spinous dorsal to tip of snout; soft dorsal and anal densely scaly. Soft dorsal concave on its margin; the seventh ray shortest, 2½ in second or longest ray. Anal similar to soft dorsal but more concave. Pectoral reaching very nearly to front of spinous dorsal. Caudal forked. Color dusky above, with bluish reflections, silvery below; no dusky streaks along sides; spinous and soft dorsal dusky, the latter finely punctulate with brown, its anterior rays tipped with black; Caudal pale, broadly margined with black; anal pale, its basal half appearing dusky from dark punctulations; pectoral pale in front, rather dusky behind, where there is a dusky blotch at base. Length 11 inches. Florida Keys to Cuba; not abundant, but common at Key West. (Named for P. Gaimard, the associate of Quoy, in the study of the animals obtained on Freycinet's voyage of the *Uranie* and the *Physicienne*, and on Dumont d'Urville's voyage of the *Astrolobe.*)

*Mugil gaimardianus*, DESMAREST, Dict. Class., pl. 109, 1831, Cuba; no description; POEY, Ann. Lyc. Nat. Hist. N. Y., 64, pl. 7, figs. 1–3, 1875, Cuba; first description; JORDAN & SWAIN, Proc. U. S. Nat. Mus., 1884, 267.

### 1189. MUGIL SETOSUS, Gilbert.

Head 3⅔ to 3¾ in length; depth 4; eye large, equaling or slightly exceeding the length of the snout, 3⅕ to 4 in head, 1¾ in interorbital width. D. IV–I, 8; A. III, 9; scales 37. Closely resembling *Mugil hospes*, from which it differs widely in its much larger multiserial setæ, and the longer, narrower mouth. Mandibular angle less than 90 degrees; length of cleft of mouth but little less than its width. Premaxillary setæ in a narrow band, not arranged in definite cross lines as in *Chænomugil*; those of outer row very long and numerous, curved and closely crowded; inner setæ much shorter, but arranged in several irregular series; mandibular setæ shorter and slenderer but larger than the premaxillary setæ of *M. curema*; in a single series; a narrow strip only of the maxillary is visible in the closed mouth. Upper lip thick. Preorbital denticulated. Adipose eyelid partly covering pupil, but much thinner than in *curema* and related species, the whole eye being visible through it in alcoholic specimens; adipose mass lying behind eye less developed, encroaching but little on the opercle. Suborbital very wide, as in *Mugil trichodon*. Scales moderate, 20 in front of dorsal, 11 in an oblique series from vent to base of dorsal. Accessory scale on each side of spinous dorsal usually longer than the base of the fin. Axillary scale exceedingly thin and membranous. Soft portions of all the vertical fins scaled to tip; basal portions of the pectorals and ventrals also scaled. Pectoral long, pointed, slightly falcate, as long as head behind front of pupil, reaching tenth or eleventh scale on sides, failing to reach front of spinous dorsal by about ⅕ its own length. Spinous dorsal lower than soft dorsal. Both soft dorsal and anal strongly falcate, the last rays much higher than middle rays, the anterior rays when depressed nearly reaching tips of last rays. Soft dorsal inserted over fourth or fifth ray of anal. Caudal longer than head, the lobes long and pointed. Plain grayish above, silvery on sides and below, without stripes or other markings. Ventrals unmarked, the other fins slightly dusky, the caudal with a distinct black margin. Very abundant at Clarion Island, of the Revillagigedo group, also found at Mazatlan, where the color is much darker than in the types which came from bottom of volcanic ashes. (*setosus*, bearing bristles.)

*Mugil setosus*, GILBERT, Proc. U. S. Nat. Mus., 1891, 549, Clarion Island. (Coll. Gilbert.)

### 1190. MUGIL TRICHODON, Poey.

(FAN-TAIL MULLET.)

Head 4⅕; depth 3⅔. D. IV–I, 8; A. III, 8; scales 33–11. Body rather robust, its depth somewhat greater than in *Mugil curema*. Snout rather narrow and pointed, the upper and lower profile about equally oblique. Interorbital space flattish or slightly convex, 2½ in head. Upper lip thick, thicker than in any other species here described. Space at the chin between the mandibulary bones oblanceolate, acutish posteriorly. Preorbital narrow, covering little of maxillary. Eyes hidden anteriorly and posteriorly by a broad adipose membrane. Teeth wide-set; larger than in most other species; plainly visible in both jaws, and about as long as the nostril. Scales large, about 21 from origin of dorsal to tip of snout; soft dorsal and anal densely scaled. Soft dorsal concave; the seventh ray shortest, 2¾ in second or longest ray; anal similar to soft dorsal. Pectoral not reaching nearly to front of spinous dorsal, Caudal broad, forked. Color dusky olive above, with some bluish reflections; silvery below. No dusky streaks along the rows of scales. A dark blotch at base of pectoral. Dorsals and caudal pale, the former with very small dark punctulations. Caudal margined with blackish. Anal and ventrals yellowish. Pectorals pale, finely punctulate with brown. Length 10 inches. Florida Keys to Brazil; very abundant at Key West, but rare about Cuba. (ϑρίξ, hair; ὀδούς, tooth.)

*Mugil trichodon*, POEY, Ann. Lyc. Nat. Hist. N. Y., XI, 1875, 66, plate 8, figs. 4 to 8, Cuba.
*Mugil brasiliensis*, JORDAN & SWAIN, Proc. U. S. Nat. Mus., 1884, 270; not of AGASSIZ.

## 365. CHÆNOMUGIL, Gill.

*Chænomugil*, GILL, Proc. Ac. Nat. Sci. Phila., 1863, 169, (*proboscideus*).

Cleft of mouth lateral; lower jaw narrow; dentiform cilia in very many series, broad, flat, and somewhat paved; upper lip very thick; no adipose eyelid. Small mullets, of the tropical shores. (*χαίνω*, to gape; *Mugil*.)

### 1191. CHÆNOMUGIL PROBOSCIDEUS* (Günther).

Head, and especially the body and tail, compressed; the greatest depth of body nearly equals length of head, and is 4½ in total length; eye 4, shorter than snout. Dorsal IV–I, 8; anal III, 10; scales 38, 14 in transverse series, 23 before the dorsal. The front part of the upper lip is extremely thick and conically produced, nearly as long as rest of snout; low part of each lip with a band of soft pavement-like papillæ, arranged in oblique series; lower jaw rather narrow; cleft of mouth deeper than broad; in some specimens the band of papillæ passes into a series of fine movable teeth anteriorly on the upper jaw. Upper anterior profile nearly straight, obliquely descending; interorbital space convex, 2 in head, and scaly; preorbital area naked. Maxillary entirely hidden by the preorbital, which has the extremity truncated and minutely serrated. The spinous dorsal begins somewhat nearer base of caudal than to end of snout; the soft dorsal and anal with small scales between the rays, the former is higher than the spinous dorsal, and commences above the middle of the anal fin; anal fin rather higher than long, as high as soft dorsal; pectoral 1¼ in head; caudal emarginate. Silvery, upper parts greenish; dark stripes of spots along the series of scales. (Günther.) Pacific Coast of tropical America; generally common in rock pools. Length 6 inches. Known from Mazatlan, Cordova, and Panama. (*proboscideus*, having a proboscis.)

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* A second species of *Chænomugil*, possibly American, is *Chænomugil nigro-strigatus* (GÜNTHER): Head 5; depth 4⅔; dorsal IV–I, 8; anal III, 9, scales 42, 13 or 14 in a transverse series, 27 between snout and spinous dorsal. Upper lip extremely thick, without transverse fold, and with about 7 series of small flat papillæ on its inferior half; lower lip with a broad membranaceous margin, notched in the middle, but not ciliated. Interorbital space slightly convex, 2¼ in head. Snout as long as eye or longer. Chin nearly entirely covered by the mandibles. Preorbital truncate, not notched, not covering extremity of maxillary. Pectoral inserted nearly in the middle of the depth of the body, without a pointed scale in its axil; not quite as long as head,

*Mugil proboscideus*, GÜNTHER, Cat., III, 459, 1861, Island of Cordova, west coast of Central America. (Coll. G. U. Skinner and Captain Dow.)
*Chænomugil proboscideus*, JORDAN & SWAIN, Proc. U. S. Nat. Mus., 1884, 272.

## 366. QUERIMANA, Jordan & Gilbert.

*Querimana*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 588, (*harengus*).

This genus includes little mullets, with but 2 spines in the anal fin and with the teeth in the jaws less ciliiform than in *Mugil*. Adipose eyelid wanting; preorbital serrate. The species are all American, of small size, and some of them swim in great schools at the surface. *Querimana* is close to the Australian genus *Myxus*, but *Myxus* has 3 anal spines. (*Queriman*, a Portuguese name of *Mugil curema*.)

*a*. Teeth in lower jaw obsolete; species of small size.
  *b*. Scales small, 38 in a longitudinal series; dorsal fin IV–I, 8; anal II, 9 or 10. HARENGUS, 1192.
  *bb*. Scales large, 28 or 29 in a longitudinal series; dorsal fin IV–I, 8; anal II, 7 or 8. GYRANS, 1193.

### 1192. QUERIMANA HARENGUS (Günther).

(EL VERDE.)

Head 3¼; depth 3½ to 4. Dorsal IV–I, 8; anal II, 10; scales 38. Head and body compressed; cleft of mouth broader than deep, not reaching

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reaching fourteenth scale of lateral line. Spinous dorsal commences midway between snout and base of caudal, or above the sixteenth scale of lateral line; soft dorsal begins above the twenty-sixth scale, or above the third soft anal ray. Soft dorsal not scaly, much higher than long, as high as anal, which is longer than the dorsal. Body with about 11 brownish-black longitudinal streaks produced by a series of spots, one always belonging to the cuticular fold covering base of scale. (Günther.) One specimen from unknown locality, supposed to be from St. Vincent. Whether of the Cape Verde Islands or of the West Indies is unknown. (*niger*, black; *strigatus*, streaked.)

*Mugil nigro-strigatus*, GÜNTHER, Cat., III, 457, 1861, supposed to be from St. Vincent.

orbit; a single series of small fixed teeth in upper jaw, none in the lower or on the vomer; lips thin. Preorbital serrate, anteriorly and inferiorly. Anterior dorsal spines of moderate strength, 2 in head. Sides and belly bright silvery, back clear green; a large silvery blotch on each side above, fading at death. Length 2 inches. Pacific Coast of Tropical America, from Mazatlan to Peru; locally abundant. (*harengus*, herring.)

*Myxus harengus*, Günther, Cat., III, 467, 1861, Pacific Coast of Central America. (Coll. Captain Dow.)
*Querimana harengus*, Jordan & Swain, Proc. U. S. Nat. Mus., 1884, 274.

### 1193. QUERIMANA GYRANS, Jordan & Gilbert.

(Whirligig Mullet.)

Head 3¼; depth 3¾; eye 3⅗, large, equaling interorbital width, about twice length of snout. D. IV–I, 7; A. II, 7 or 8; scales 28 or 29. Body compressed, especially below; upper anterior profile descending in a curve to the short snout; top of head transversely convex; mouth rather narrow, oblique, the symphysis of lower jaw forming an acute angle. Teeth in a single series in upper jaw, rather better developed than in species of *Mugil*, but not evidently of different character. Origin of ventral fins midway between snout and end of anal fin; pectorals long, 5 times in length of body; vertical fins apparently scaleless. Some specimens (perhaps females) green above; sides and belly silvery; middle of back with a large pale area, shining silvery when in the water. Other specimens (perhaps males) with a broad coppery olive shade along the sides, extending on the back; color otherwise the same; the pale dorsal blotch as in the other; fins pale. South Atlantic Coast of United States, known from Woods Hole (Smith and Kendall) to Key West; generally abundant; a curious little mullet, often found swimming round and round in great schools at the surface like whirligig beetles; usually mistaken for the young of the mullet or the bluefish. According to Mr. W. C. Kendall it is common off Fortress Monroe, Virginia. Close to *Querimana harengus*, but differing in coloration, size of scales, fin rays, etc. Length 2 inches. (*gyrans*, whirling.)

*Querimana gyrans*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1884, 26, Key West; Smith, Bull. U. S. Fish Comm., XI, 1891, 192. (Type, No. 34966. Coll. Jordan.)

## 367. AGONOSTOMUS, Bennett.

*Agonostomus*, Bennett, Proc. Comm. Zoöl. Soc., 1830, 166, (*telfairii*).
*Dajaus*, Cuvier & Valenciennes, Hist. Nat. Poiss., XI, 164, 1836, (*monticola*).
*Nestis*, Cuvifr & Valenciennes, *l. c.*, XI, 166, 1836, (*cyprinoides* = *telfairii*).

Fresh-water mullets, with cleft of mouth extending laterally about to front of eye. Small teeth in villiform bands in both jaws, and sometimes on the vomer. Edge of lower lip rounded, not sharp. Stomach not gizzard-like. Anal spines usually 2, the first soft ray slender and often taken for a spine. Streams of mountainous regions in tropical countries. The American species constitute the subgenus *Dajaus*, characterized by the presence of teeth on the palatines. (ἀ–, without; *γωνία*, angle; *δτόμα*, mouth.)

*a.* Interorbital space flat, narrow, 4 in head; head 3⅔; depth 4⅓ to 4½; lips thin; scales 40 to 42–13. PERCOIDES, 1194.

*aa.* Interorbital space convex, broad, 2⅔ to 3 in head.

*b.* Lips thin; body rather deep; maxillary to front of eye. MONTICOLA, 1195.

*bb.* Lips thick.

*c.* Maxillary short, barely reaching front of eye, 4 in head; eye 5 in head; head 4¼ in length. NASUTUS, 1196.

*cc.* Maxillary long, reaching posterior margin of pupil, 2½ in head; eye very small, 6½ in head; head 3½ in length. MICROPS, 1197.

### Subgenus DAJAUS, Cuvier & Valenciennes.

### 1194. AGONOSTOMUS PERCOIDES, Günther.

Head 3⅔; depth 3¾. Dorsal IV–I, 8; anal III, 9; scales 40 to 42–13. Villiform teeth in the jaws and on the vomer and palatines; upper lip thin; maxillary reaching beyond front of eye; interorbital space flat, its width 4 in head, rather greater than diameter of orbit, which equals length of snout. Origin of spinous dorsal midway between snout and base of caudal; length of anterior spine more than half that of head. Soft dorsal as high as the spinous; caudal deeply emarginate; anal fin higher than soft dorsal; pectoral as long as head without snout; ventrals somewhat shorter than the pectoral fins. Nearly uniform greenish (in spirits); blackish blotches between the dorsal spines. (Günther.) Fresh waters of San Domingo and probably of other islands. (*percoides*, περκοειδής, like a perch.)

*Agonostoma percoides*, GÜNTHER, Cat., III, 464, 1861, San Domingo.

### 1195. AGONOSTOMUS MONTICOLA (Bancroft).

Depth 4⅓ to 4½ in total length (about 3¾ without caudal). Dorsal IV–I, 8; anal III, 9; scales 40 to 42, 12 in transverse series. Small teeth in jaws and on the vomer and palatines. Upper lip thin; maxillary reaching eye; interorbital space convex. Spinous dorsal somewhat nearer snout than base of caudal. (Günther.) Fresh waters of the West Indies and eastern Mexico, Vera Cruz, etc. (*monticola*, inhabiting mountains.)

*Mugil monticola*, BANCROFT, in Griffith's Edition Cuvier's Animal Kingdom, Fishes, 367, plate 36, 1836.

*Mugil irretitus*, GOSSE, Nat. Sojourn Jamaica, 84, 1851, Jamaica.

*Agonostoma monticola*, GÜNTHER, Cat., III, 464, 1861.

### 1196. AGONOSTOMUS NASUTUS, Günther.

### (TRUCHA.)

Head 4¼; depth 4¼; eye 1½ in snout or 5 in head. Dorsal IV–I, 8; anal III, 9; scales 42–12 in transverse series, 19 scales before the dorsal. Body moderately compressed, rather thick behind the head; upper anterior profile slightly convex above the opercles. Snout obtusely conic. Preorbital not toothed. Rather narrow bands of villiform teeth in the jaws, on the vomer, and on the palatines. Upper lip thick; mouth oblique, of moderate width, maxillary reaching eye, entirely hidden when mouth is closed. Interorbital space convex, 2⅔ in head. Anterior dorsal commences nearer snout than base of caudal, and above tenth scale of lateral line; its anterior spines rather strong, 2 in head. Soft dorsal a little higher than the spinous, not scaly, commencing above the twenty-fourth scale, or above the fourth anal ray; caudal fin emarginate; anal fin somewhat higher than the dorsal, spines feeble, the first quite rudimentary; pectoral inserted above the middle of the depth of body, as long as distance from nostril to posterior edge of opercle. Back grayish green, each scale with a brown margin; a silvery band from base of pectoral to caudal fin; lower parts silvery; base of pectoral blackish. (Günther.) Rivers of Central America, on both sides of the isthmus, north to Lower California.* (*nasutus*, long-nosed.)

*Agonostoma nasutum*, GÜNTHER, Cat., III, 463, 1861, Rio Geronimo; GÜNTHER, Fishes Central America, 444, plate 70, fig. 2, 1866.

### 1197. AGONOSTOMUS MICROPS, Günther.

Head 3½; depth 4¼; snout much longer than eye of male, which is 6½ in head. Dorsal IV–I, 8; anal III, 9; scales 43–12 in transverse series. Bands of villiform teeth in the jaws, on the vomer, and on the palatine and pterygoid bones. Upper lip thick, protruding anteriorly; maxillary extending beyond the vertical from anterior margin of eye; 2½ to 3 in head; interorbital space convex. Distance between dorsal fins not as great as length of head; anterior dorsal commencing midway between snout and base of caudal. (Günther.) Streams of West Indies and Central America. (*μικρός*, small; *ὤψ*, eye.)

*Agonostoma microps*, GÜNTHER, Cat., III, 462, 1861, probably West Indies.
*Dajaus microps*, GÜNTHER, Fishes Central America, 444, plate 70, fig. 1, 1866.

## 368. JOTURUS, Poey.

*Joturus*, POEY, Memorias, II, 263, 1861, (*pichardi*).

Large fresh-water mullets, with the head heavy, the blunt and tumid snout projecting beyond the small, inferior mouth; mouth broad, with little lateral cleft; lower lip very thick, its edge forming a soft sharp-edged fold, its outline very obtuse. Teeth coarse, blunt incisors, with serrated edges, arranged in broad patches on jaws and vomer; two patches of lower jaw not confluent. No adipose eyelid. First dorsal with four spines; anal with three; scales large. One species, living at the foot of waterfalls in tropical America. (*Joturo*, the Spanish name of *Joturus pichardi* at Havana.)

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*Specimens from San Jose del Cabo, near Cape San Lucas, obtained by Mr. Lyman Belding, are thus described:

Head 4¼ to 4½ in length (to base of caudal); eye 4⅓ in head; maxillary not longer than interorbital width, contained 2¾ to 3¼ times in head; a band of pterygoid teeth often but not always developed; dorsal spines very strong, not flexible, the origin of the fin nearer snout than tail; caudal well forked, the middle rays 1½ in outer; maxillary usually extends slightly beyond front of orbit.

Other specimens obtained by the Hopkins Expedition at Mazatlan are described as follows:

Head 4¼; depth 4⅓. D. IV–I, 8; A. II, 10; scales 43–13. Eye 3⅔ in head; snout 3⅔; maxillary 3⅓. Pectoral 1⅓ in head; caudal as long as head. Body moderately elongate, not much compressed; nape prominent, rounded. Interorbital space much rounded, its width 3 in head. Preorbital narrow, as wide as pupil; mouth rather small, the maxillary reaching front of pupil; lower jaw included. Eye large, without adipose eyelid. Teeth small, sand-like, in bands; vomer roughish. Gill rakers slender, close-set. Pectoral short, not reaching spinous dorsal, the ventrals inserted under middle of its length; ventrals with a small accessory scale; anal and soft dorsal scaleless, their free edges concave; caudal well forked. Olivaceous; sides creamy; belly silvery; back and sides with many black scales scattered about, making irregular spots. Pectoral with a conspicuous black bar at base, crossed by a pale streak; a narrow dark rim around lower half of eye. Fins all creamy yellow, the upper ones dotted and clouded with black. Young with a black blotch on first dorsal, surrounded by orange. Pectoral bar and mottled scales of body evident in young and old. Length 8 to 12 inches. Rivers of Sinaloa; very abundant in rapid places in clear waters; our specimens from Rio Presidio. Locally known as Trucha or Trout.

### 1198. JOTURUS PICHARDI, Poey.

(JOTURO; BOBO.)

Head $4\frac{4}{5}$; depth $3\frac{3}{5}$; eye 6 in head, 3 in interorbital width; snout $2\frac{2}{3}$. D. IV–I, 9; A. III, 9; scales 42 to 45–13 or 14; vertebræ 11 + 13. Body robust, a little compressed behind. Head heavy, little compressed, gibbous above and anteriorly. Snout thick, broad, protruding, blunt and tumid at tip, considerably overhanging the small inferior mouth, and entirely below the level of the eye. Maxillary reaching nearly to posterior margin of eye, $2\frac{1}{2}$ in head, hidden entirely beneath the preorbital. Mouth broad, but without much lateral cleft; lower jaw included. Upper lip thick, slipping beneath the snout. Lower lip very thick, its anterior edge forming a soft sharp-edged fold; outline of the lip very obtuse. Teeth rather strong, coarse, bluntly conical, forming a large ovate patch on each side of lower jaw, the two patches not confluent; a similar but smaller patch on the vomer; no teeth on the palatines; upper jaw with a band of similar but rather smaller teeth. Nostrils roundish, close together, in front of the small round eye, which is nearer angle of mouth than level of top of head. Interorbital space very broad, transversely convex. No adipose eyelid. Neither lip with cirri or papillæ. Scales of head each with many smaller ones at base; accessory scales on body largely developed. All the fins, including spinous dorsal, covered with small scales. Gill membranes largely united, free from the isthmus. Dorsal spines compressed and curved, becoming rapidly shorter from the first, which is about two-thirds length of head. Second dorsal and anal with their free margins concave, the anal somewhat falcate, its longest ray $1\frac{1}{6}$ in head. Caudal forked, as long as head. Pectoral as long as head, reaching middle of first dorsal. Color dull olivaceous, without distinct markings; paler below. Length 2 feet. Cuba, Panama, Costa Rica, and Vera Cruz; a robust, vigorous fish, living in mountain torrents; common in Rio Almendares near Havana, and known from the mountain streams of Costa Rica, and from streams about Panama. Used as a food-fish in Havana. (Named for Don Esteban Pichardo, "estimable auteur d'un 'Diccionario Provincial de voces Cubanos.'")

*Joturus pichardi*, POEY, Memorias, II, 263, 1861, Cascades throughout Cuba; JORDAN, Proc. U. S. Nat. Mus., 1886, 35.

*Agonostoma globiceps*, GÜNTHER, Ann. Mag. Nat. Hist., (4) XIV, 370, 1874, Myzantla, Vera Cruz.

*Joturus stipes*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 373, Rio Bayano near Panama. (Type, No. 31010. Coll. Captain Dow.)

## Family CVIII. SPHYRÆNIDÆ.

### (The Barracudas.)

Body elongate, subterete, covered with small cycloid scales. Head very long, pointed, pike-like, scaly above and on sides. Mouth horizontal, large. Jaws elongate, the lower considerably projecting; upper jaw non-protractile, its border formed by the premaxillaries, behind which are the broad maxillaries; large, sharp teeth of unequal size on both jaws and on palatines; none on the vomer; usually a very strong, sharp canine near the tip of the lower jaw. Opercular bones without spines or serratures. Gill openings wide, the gill membranes not united, free from the isthmus; gill rakers very short or obsolete. Branchiostegals 7; gills 4, a slit behind the fourth. Pseudobranchiæ well developed. Air bladder large, bifurcate anteriorly; many pyloric cœca. Lateral line well developed, straight. Pectoral fins short, placed in or below the line of the axis of the body; ventrals I, 5, abdominal, in advance of the middle of the body; first dorsal over ventrals, of 5 rather stout spines; second dorsal remote from first dorsal, similar to anal and opposite to it; caudal fin forked. Vertebræ 24. First superior pharyngeal not present. Second, third, and fourth separate, with teeth. Lower pharyngeals separate. A single genus of about 20 species; carnivorous pike-like fishes, often of large size, active and voracious, inhabiting warm seas, many of them highly valued as food. (*Sphyrœnidœ*, Günther, Cat., II, 334–341, 1860.)

## 369. SPHYRÆNA* (Artedi) Bloch & Schneider.

### (Barracudas.)

*Sphyræna* (Artedi) Bloch & Schneider, Syst. Ichth., 109, 1801, (*sphyræna*).
*Sphærina*, Swainson, Class'n Fishes, II, 175, 1839, (*europæa* = *sphyræna*).

Characters of the genus included above. (*σφύραινα*, the ancient name, "hammer fish," from *σφῦρα*, a hammer.)

*a.* Scales large, 75 to 85 in lateral line; origin of first dorsal behind root of ventrals, over last third or fourth of pectorals; body compressed; lower jaw with fleshy tip; maxillary reaching past front of orbit; teeth large. PICUDA, 1199.
*aa.* Scales moderate, 110 to 130 in lateral line; body subterete or compressed.
  *b.* Pectorals reaching front of spinous dorsal; maxillary reaching front of orbit; origin of spinous dorsal behind root of ventrals.
    *c.* Lower jaw with fleshy tip; teeth very strong; scales in lateral line 110. ENSIS, 1200.
    *cc.* Lower jaw without fleshy tip; teeth strong; lateral line 130. GUACHANCHO, 1201.
  *bb.* Pectorals not reaching front of first dorsal; maxillary not reaching front of orbit.
    *d.* Eye large; teeth small; interorbital area convex; median ridge of frontal groove not well developed. PICUDILLA, 1202.
    *dd.* Eye small; teeth larger; interorbital space flattish; median ridge of frontal groove prominent. BOREALIS, 1203.
*aaa.* Scales very small, 150 to 170 in lateral line; origin of spinous dorsal well behind tip of pectorals, before the vertical from root of ventrals; lower jaw with fleshy tip. Body slender, subterete.

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* For a detailed account of the American species of this genus see Meek & Newland, Proc. Ac. Nat. Sci. Phila., 1884, 67, et seq.

*e.* Body less slender, depth $7\frac{1}{2}$ in length; scales in lateral line 160 to 170. ARGENTEA, 1204.

*ee.* Body very slender, depth 9 or 10 in length; scales in lateral line 150. SPHYRÆNA, 1205.

### 1199. SPHYRÆNA PICUDA, Bloch & Schneider.

(GREAT BARRACUDA; PICUDA; BECUNA.)

Head 3; depth 2 in head; eye rather small, about 6 in head, equal to width of interorbital area. D. V–I, 9; A. I, 9; scales 10–75 to 85–10, the cross series counted from lateral line to front of dorsal and anal fins respectively. Body oblong, slightly compressed, covered with large scales. Head large; maxillary large; nearly $\frac{1}{2}$ length of head, its posterior margin reaching past front of orbit. Lower jaw with fleshy tip, bluntly conical. Interorbital area concave, with a shallow median groove (as wide as pupil, at posterior edge of orbit), divided by a ridge in front and behind. Supraocular ridge bony and striate. Preocular ridge present. Teeth large; premaxillary teeth small, little compressed, irregularly set, nearly uniform in size, somewhat thicker and shorter posteriorly; premaxillary with two pairs of very large compressed teeth, their length more than half width of pupil; anterior ones directed downward, posterior ones downward and backward; teeth in lateral series of lower jaw small anteriorly, increasing gradually backward, when they nearly equal those on palatines; palatine teeth similar to those on lower jaw, arranged in reversed order. Distance from tip of snout to front of dorsal $2\frac{2}{7}$ in body; second dorsal spine longest, $1\frac{1}{3}$ in snout; second dorsal and anal equal; anal inserted under first third of soft dorsal; caudal forked, upper lobe the longer; pectorals reaching beyond front of dorsal, $2\frac{1}{2}$ in head; origin of first dorsal slightly behind the ventrals; cheeks and opercles scaly, about 12 rows of scales on cheeks; upper part of head with small embedded scales. Color silvery, darker above; sides in young with about 10 dark blotches which break up and disappear with age. Some inky spots, usually on posterior part of body, are very conspicuous in both old and young specimens. Soft dorsal, anal and ventral fins black, except on margins. Pectorals plain, except upper part of its margin; which is black. Fins of very young specimens nearly plain. West Indies and Brazil, north to Pensacola, Charleston, and the Bermudas, very common in the tropics. The largest and most voracious of the Barracudas, reaching a length of 6 feet; valued as food; sometimes dangerous to bathers, being fierce as a shark. (*Picuda*, the Spanish name, from the same root as pike.)

*Umbla minor marina*, the Barracuda, CATESBY, Fishes of Carolina, etc., pl. 1, 1731, Bahamas.

*Picuda*, PARRA, Dif. Piezas, Hist. Nat. Cuba, 90, pl. 35, fig. 2, 1787, Havana.

*Sphyræna sphyræna*, var. *picuda*, BLOCH & SCHNEIDER, Syst. Ichth., 110, 1801; after PARRA.

*Sphyræna becuna*, LACÉPÈDE, Hist. Nat. Poiss., v, pl. 9, fig. 3, 1803, from a drawing made by PLUMIER, at Martinique.

*Esox barracuda*, SHAW, Zool., v, 105, 1804; after CATESBY.

*Sphyræna picuda*, GÜNTHER, Cat., III, 336, 1861; JORDAN & GILBERT, Synopsis, 412, 1883; MEEK & NEWLAND, Proc. Ac. Nat. Sci. Phila., 1884, 68.

### 1200. SPHYRÆNA ENSIS, Jordan & Gilbert.

(Vicuda.)

Head 4; depth 8 or 9; eye 6 to 7 in head; snout 2¼. D. V–I, 9; A. II, 8; scales 110. Body moderately elongate. Pectoral 2¾, reaching about to front of first dorsal. Ventrals inserted before first dorsal. Canine teeth of lower jaw, palatines, and inner row of premaxillary very large, much as in *Sphyræna picuda*. Maxillary reaching about to front of dorsal. Silvery, darker above, with traces of numerous vague darker crossbars. Gulf of California to Panama; rather common; a food-fish of some importance. Length about 2 feet. (*ensis*, sword.)

*Sphyræna ensis*, Jordan & Gilbert, Bull. U. S. Fish Comm., II, 1882, 106, Mazatlan; (Type, No. 28210, Coll. Gilbert); Meek & Newland, Proc. Ac. Nat. Sci. Phila., 1884, 70.

*Sphyræna forsteri*, Steindachner, Ichth. Beiträge, VII, 4, 1878; not of Cuvier & Valenciennes, which is an East Indian species.

### 1201. SPHYRÆNA GUACHANCHO, Cuvier & Valenciennes.

(Guaguanche; Guaguanche Pelon.)

Head 3¼; depth 2 in head; eye rather large, 5½ in head, a little exceeding interorbital area. D. V–I, 9; A. I, 8; scales in lateral line 120 to 130. Body rather slender, subterete, covered with moderate-sized scales; head large; maxillary small, less than ½ head, scarcely reaching orbit; lower jaw bluntly conical, without fleshy tip. Interorbital area flat; median groove very shallow, the median longitudinal ridge very small, anterior; supraocular ridge bony, striate; preocular ridge large. Premaxillary teeth small, 35–40 in number; premaxillary teeth present; anterior palatine teeth larger and more compressed than those on premaxillary, widely set, decreasing in length gradually; teeth in lateral series of lower jaw small and closely set anteriorly, larger and wide-set posteriorly, about 10 in number; a large compressed tooth at symphysis. Origin of first dorsal above tip of pectoral, slightly behind the ventrals; distance between dorsals 5½ in body; distance from tip of snout to spinous dorsal 2⅓ in body; scales moderate, almost uniform in size; cheeks and opercles scaly; upper part of head with small embedded scales. Color light olive, yellowish on soft dorsal; anal and ventral tips of caudal rays black; top of head dark; dark punctulations on upper part of body; spinous dorsal with some dark punctulations. West Indies, north to Pensacola, and occasionally northward in the Gulf Stream as far as Woods Hole. A slender species, rather common in the tropics. Length 2 feet. (*Guaguanche*, the common name in Cuba.)

*Sphyræna guachancho*, Cuvier & Valenciennes, Hist. Nat. Poiss., III, 342, 1829, (lapsus for *guaguanche*), Havana; (Coll. Poey); Jordan & Gilbert, Synopsis, 411, 1883.

*Sphyræna güntheri*, Haly, Ann. Mag. Nat. Hist., XV, 1875, 270, Colon.

*Sphyræna guaguanche*, Poey, Memorias, II, 166, 1860; Meek & Newland, Proc. Ac. Nat. Sci. Phila., 1884, 70.

### 1202. SPHYRÆNA PICUDILLA, Poey.

(Picudilla.)

Head 3⅙; depth 2¼ in head; eye large, about 5 in head, 1½ times interorbital space. D. V–I, 9; A. I, 9; scales 110. Body rather robust, subterete, covered with scales of moderate size; head rather large; maxillary rather small, about 2⅗ in head, not reaching orbit. Jaw with fleshy tip, bluntly conical. Interorbital area flattish; median groove shallow, divided by a very indistinct median ridge; supraocular ridge bony, striate; preocular ridge rather prominent. Premaxillary teeth small, subconical; dentition as in *Sphyræna borealis*, but slightly weaker; position of spinous dorsal, in comparison with ventrals, variable; distance from tip of snout to origin of spinous dorsal about 2⅒ in body; pectorals not reaching spinous dorsal; space separating dorsals about 5½ in body; second dorsal equal to and somewhat in advance of anal; cheeks and opercles scaly; small embedded scales on upper part of head; scales on body moderate, uniform in size. Color light olive, darker above; soft dorsal, anal and ventral fins yellowish; spinous dorsal and pectorals darker; upper parts of preopercle and opercle each with a dark spot; top of head and tip of snout blackish. Not rare. West Indies, on the coasts of Cuba, ranging southward to Bahia. Length 18 inches. *S. picudilla* is very closely allied to *S. borealis.* Its eye is, however, much larger (when specimens similar in size are compared), and the frontal groove is somewhat different. (*picudilla*, diminutive of *picuda.*)

*Sphyræna picudilla*, Poey, Memorias, II, 162, 1860, Havana; Meek & Newland, Proc. Ac. Nat. Sci. Phila., 1884, 72.

### 1203. SPHYRÆNA BOREALIS, De Kay.

(Northern Barracuda.)

Head 3; depth 2⅗; eye rather small, about 6 in head, scarcely exceeding width of interorbital area. D. V–9; A. I, 9; scales 115 to 130. Body rather slender, subterete, covered with moderate-sized scales; head large; maxillary small, less than ½ head, not reaching front of orbit by ½ diameter of eye; lower jaw with fleshy tip, bluntly conical. Interorbital area convex; median groove very shallow, divided by a distinct longitudinal ridge, especially well defined immediately before nostrils; supraocular ridge striate; preocular ridge moderate. Premaxillary teeth small, about 40 in number; front of premaxillary with two pairs of large teeth (sometimes accompanied by smaller ones), canine-like; anterior smallest, directed downward, posterior ones downward and backward; anterior palatines larger than premaxillary teeth, and more compressed and widely set; posterior ones small and closely set; order of teeth on lower jaw reversed, but similar to those on the palatines, and smaller, about 10 in series; large tooth near tip of lower jaw present. Origin of dorsal over or slightly in advance of ventrals, well behind point of pectorals; distance between dorsal fins 5¼ in length of body; distance from tip of snout to spinous dorsal 2⅒ in body; scales moderate, somewhat larger behind soft dorsal and anal; cheeks and opercles scaly; small embedded scales on upper parts of head. Color olivaceous, silvery below; young with dusky blotches across the back and along the lateral line. Atlantic Coast of United States from Cape Cod to Cape Fear, rather common northward; a small species closely allied to *Sphyræna picudilla*; rarely used for food. Length rarely more than a foot. (*borealis*, northern.)

*Sphyræna borealis*, DE KAY, N. Y. Fauna: Fishes, 37, plate 60, fig. 196, 1842, **New York**; MEEK & NEWLAND, Proc. Ac. Nat. Sci. Phila., 1884, 73.

*Sphyræna spet*, JORDAN & GILBERT, Synopsis, 411, 1883; not of HÄUY.

### 1204. SPHYRÆNA ARGENTEA, Girard.

(CALIFORNIA BARRACUDA; BARRACOUTA.)

Head $3\frac{2}{3}$; depth $7\frac{1}{2}$; eye 10. D. V–I, 9; A. I, 8; scales in 238 series, 166 in the lateral line. Body elongate, little compressed. Lower jaw much produced, fleshy at tip. Maxillary not reaching front of eye, about 3 in head. Teeth moderate, little compressed. Spinous dorsal inserted a little nearer snout than caudal, just in front of ventrals, well behind the end of the pectorals, which are a little longer than the ventrals and less than $\frac{1}{10}$ the total length. Scales very small. Brownish, with bluish luster; belly white, scarcely silvery. Length 5 feet. Pacific Coast, from San Francisco southward to Cape San Lucas; very abundant about the Santa Barbara Islands. A long and slender Barracuda, very closely related to the European *Sphyræna sphyræna*; an important food-fish with flesh rich, firm, and delicate. (*argenteus*, silvery.)

*Sphyræna argentea*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 144, **San Diego, California**; MEEK & NEWLAND, Proc. Ac. Nat. Sci., 1884, 75.

*Sphyræna lucasana*, GILL, Proc. Ac. Nat. Sci. Phila., 1863, 86, **Cape San Lucas.**

### 1205. SPHYRÆNA SPHYRÆNA (Linnæus).

(EUROPEAN BARRACUDA; SPET; SENNET.)

Head $3\frac{1}{2}$; depth 9 to 10 in total length; eye 8. D. V–I, 9; A. I, 9; scales 150–25 to 30; vertebræ 24. Operculum with a single point; lower jaw with a long fleshy appendage anteriorly. Pectoral 12 in total length, and nearly equal to that of the ventrals; the spine of the latter is not much shorter than the rays. The origin of the first dorsal is far behind the extremity of the pectorals, and somewhat before the vertical from the root of the ventrals, in the middle of the length of the fish, the caudal not included. The interspace between the 2 dorsals is equal to $\frac{1}{6}$ of the total length. Above uniform greenish lead-colored, beneath silvery; the color of the back sometimes emits crossbars intersecting the lateral line. Young individuals brown spotted. Coasts of southern Europe and neighboring islands; rather common; recorded from the Bermudas by Dr. Goode. (Eu.) (*Sphyræna*, σφύραινα, the ancient name.)

*Esox sphyræna*, LINNÆUS, Systema Naturæ, Ed. x, 313, 1758, **Mediterranean Sea**; after *Sphyræna* of ARTEDI.

*Esox spet*, HÄUY, Encycl. Meth. Poiss., 1787; after LINNÆUS.

*Sphyræna vulgaris*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., III, 327, 1829, **Mediterranean**; GÜNTHER, Cat., II, 334, 1860.

*Sphyræna viridescens*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., III, 339, 1829, **St. Jago, Cape Verde Islands.**

*Sphyræna spet*, GOODE, Bull. U. S. Nat. Mus., v, 1876, 61.

Remotely allied to the *Percesoces* but showing also certain Percoid characters is the singular

## Suborder RHEGNOPTERI.

Actinosts of pectoral fin of 3 forms, 2 of them normal, supporting the pectoral fin, 1 of them longitudinal, without rays, and the fourth a plate on the coracoid, supporting 3 to 10 free and separate rays or feelers. Post-temporal and shoulder girdle normal; vertebræ 10 + 14 = 24; 2 separate dorsal fins, the first of a few spines. Pseudobranchiæ concealed; ventrals subabdominal, behind pectorals. One family, *Polynemidæ*, of uncertain origin and affinities. (*ῥηγνύω*, to break asunder; *πτερόν*, fin.)

## Family CIX. POLYNEMIDÆ.*

(The Threadfins.)

Body oblong, compressed, and covered with rather large, loosely inserted, ctenoid scales. Lateral line continuous, continued on the tail, usually forked, with a branch on each lobe. Head entirely scaly; snout more or less conical, projecting over the mouth, which is rather large, inferior, with lateral cleft; premaxillary protractile, its basal process vertical; maxillary without supplemental bone, extending much beyond the eye, which is anterior, lateral, rather large, with a well-developed, adipose eyelid. Villiform teeth on jaws, palatines, and sometimes on vomer. Pseudobranchiæ concealed. Branchiostegals 7. Gill membranes separate and free from the isthmus. Gills 4, a slit behind the fourth. Two separate dorsals, somewhat remote from each other, the first of 8 feeble but rather high spines, the first and last spines very short, the third longest; the second dorsal equal to first in height but base somewhat longer, of soft rays only. Anal fin either similar to or much longer than soft dorsal; caudal fin rather long, widely forked. Second dorsal, anal, and caudal fins more or less covered with small scales; the first 3 or 4 dorsal spines winged. Ventrals I, 5, abdominal, but not far removed from pectorals; pectoral fins moderate, placed low, in two parts, the lower and anterior portion of several filiform articulated appendages, free from each other, used as organs of touch. In the young the dorsal, caudal, and pectoral fins are dusky, the anal and ventral fins white; all the fins grow darker with age, the pectorals usually becoming black, the operculum blackish. Bones of the skull with a well-developed muciferous system as in *Sciænidæ*. Basis cranii double, with muscular tube; post-temporal bifurcate; hypercoracoid with median foramen; superior pharyngeal bones 4. Pectoral actinosts divided; 2 of them normal, supporting the pectoral fin, 1 longitudinal, without rays, and 1 a plate on the coracoid, supporting the pectoral filaments. Stomach cœcal, with a few pyloric appendages. Air bladder various, sometimes wanting. Vertebræ 10 + 14 = 24. Genera 4, *Galeoides*,

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* For a review of this family see Kirsch, Annals N. Y. Ac. Sci., v, April, 1890, 231–236.

*Polistonemus*, *Polynemus*, and *Polydactylus*; the last 2 only are found in America; species about 25, inhabiting sandy shores of tropical seas, and sometimes entering rivers. Most of them are valued as food-fishes, their flesh resembling that of the *Sciænidæ*. The relations of this peculiar family appear to be with the *Sciænidæ* on the one hand, and with the *Mugilidæ* on the other, but all these resemblances may be superficial. (*Polynemidæ*, Günther, Cat., II, 331–340, 1860.)

*a.* Anal fin much longer than soft dorsal, of about 30 rays; vomer without teeth; preoperculum entire; free filaments of pectorals longer than body. POLYNEMUS, 370.

*aa.* Anal fin not much longer than soft dorsal, of about 13 or 14 rays; vomer with teeth; preoperculum serrate; free filaments of pectorals mostly shorter than body. POLYDACTYLUS, 371.

## 370. POLYNEMUS (Gronow) Linnæus.

*Polynemus*, GRONOW, Mus. Ichthyol., 31, 1754, (*quinquarius*).
*Pentanemus*, ARTEDI, Sebæ Thesaurus, III, 74, 1758, (*quinquarius*).
*Polynemus*, LINNÆUS, Syst. Nat., Ed. X, 1758, 317, (in part; *quinquarius*; *virginicus*; *paradisæus*).
*Pentanemus*, GÜNTHER, Cat., II, 331, 1860, (*quinquarius*).
*Polynemus*, GILL, Proc. Ac. Nat. Sci. Phila., 272, 1861, (restricted to *quinquarius*).

Anal fin much longer than soft dorsal, of about 30 rays; vomer without teeth; preoperculum entire; free filaments of pectorals longer than body. In other respects essentially as in *Polydactylus*. (πολύς, many; νῆμα, thread.)

### 1206. POLYNEMUS QUINQUARIUS, Linnæus.

D. VIII–I, 12; A. III, 30; scales 7–73–17. Anal fin much longer than soft dorsal, of about 30 rays; vomer without teeth; preoperculum entire; free filaments of pectorals 5 in number, longer than body. Atlantic Ocean; West Indies to coast of Africa; recorded from Cuba, Ashantee, and the River Niger; very rare, and for a long time unknown in collections; not seen by us. (*quinquarius*, from the Latin *quinque*, five.)

*Polynemus*, GRONOW, Mus. Ichthyol., 31, 1754, American Ocean, from a specimen in the Museum of Seba.
*Pentanemus*, ARTEDI, "Sebæ Thesaurus, III, 74, 1758," Museum of Seba.
*Polynemus quinquarius*, LINNÆUS, Syst. Nat., Ed. X, 1758, 317, America; after GRONOW; GRONOW, Cat., Ed. Gray, 176, 1854, "Oceano America."
*Pentanemus quinquarius*, GÜNTHER, Cat., II, 331, 1860; from Cuba.
*Polynemus artedii*, BENNETT, Proc. Zoöl. Soc., 1831, 146, Africa.
*Polynemus macronemus*, PEL, Bydrage tot de Dierk., 9, 1851, Africa.

## 371. POLYDACTYLUS, Lacépède.

(BARBUDOS.)

*Trichidion*, KLEIN, Historia Piscium, Missus., V, 28, 1749, (*Piracoaba*, MARCGRAVE = *virginicus*), (non-binomial).
*Polynemus*, LINNÆUS, Syst. Nat., Ed. X, 1758, 317, (in part, *quinquarius*; *virginicus*; *paradisæus*).
*Polydactylus*, LACÉPÈDE, Hist. Nat. Poiss., VIII, 181, 1832, (*plumieri* = *virginicus*), thus leaving *Polynemus* as the name of *quinquarius*.
*Polynemus*, GÜNTHER, Cat., II, 319, 1860, (*paradisæus*).
*Trichidion*, GILL, Proc. Ac. Nat. Sci. Phila., 1861, 274, (*plumieri* = *virginicus*).

Anal fin not much longer than soft dorsal, of about 13 or 14 rays ; vomer with teeth ; preoperculum serrate ; free filaments of pectorals mostly shorter than body. Teeth in villiform bands on both jaws, vomer, palatines, and pterygoids. Preopercle sharply serrated on its posterior margin, its angle with a scaly flap. Scales rather small, finely ctenoid. First dorsal with 7 or 8 feeble, rather high spines, the first and last short. Soft dorsal and anal fins about equaling each other ; pectoral filaments 3 to 9. Pyloric cœca in great number. Species numerous, in warm seas. (*πολύς*, many ; *δάκτυλος*, finger.)

*a.* Pectoral filaments 6 (rarely 5). APPROXIMANS, 1207.
*aa.* Pectoral filaments 7. VIRGINICUS, 1208.
*aaa.* Pectoral filaments 8 or 9.
  *b.* Maxillary less than ½ length of head. Pectoral filaments 8. OCTONEMUS, 1209
  *bb.* Maxillary more than ½ length of head. Pectoral filaments usually 9. OPERCULARIS, 1210.

### 1207. POLYDACTYLUS APPROXIMANS (Lay & Bennett).

(RATON.)

Head 3⅓ ; depth 3. D. VIII–I, 12 ; A. III, 13 or 14 ; scales 6–62–10. Body rather deep, compressed, the back elevated, anterior profile from snout to spinous dorsal slightly convex ; maxillary 2⅓ in head ; snout 7 in head ; eye large, less than interorbital space, 5 in head. Scales rather large. Longest dorsal spine 1⅓ in head ; caudal lobes somewhat longer than head ; pectoral fin 1⅕ in head ; pectoral filaments 6 (rarely 5) in number, longer than head, reaching to front of anal fin in adult. Color yellowish white, darker above ; pectorals black in adult. Length 1 foot. Pacific Coast of tropical America, from Guaymas to Panama ; a common food-fish, known from Guaymas, Mazatlan, Chiapam, Punta Arenas, and Panama. (*approximans*, approaching.)

*Polynemus approximans*, LAY & BENNETT, Beechey's Voyage, Zoöl. Fish., 57, 1849, Mazatlan; GÜNTHER, Fish. Centr. Amer., 423, 1869; JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 365, 376; JORDAN, Cat. Fish. N. Amer., 66, 1885.
*Polynemus californiensis*, THOMINOT, Bulletin de la Société Philomathique de Paris, Séance du 27 Juin, 1886, California.
*Trichidion approximans*, GILL, Proc. Ac. Nat. Sci. Phila., 258, 1862.

### 1208. POLYDACTYLUS VIRGINICUS (Linnæus).

(BARBUDO ; BARBU.)

Head 3⅓ ; depth 3⅓. D. VIII–I, 9 to 12 ; A. III, 13 or 14 ; scales 7–71–10. Body deep, compressed, anterior profile nearly straight ; maxillary 2¼ in head ; length of snout 5 in head ; eye large, equal to interorbital space, 5 in head. Scales moderate. Longest dorsal spine equal to longest ray of soft dorsal and 1½ in head ; caudal lobes about as long as head ; pectoral fin 1½ in head ; pectoral filaments 7 in number, somewhat longer than head, reaching to front of anal fin, in adult. Color yellowish white, darker above ; scales on back with dark punctulations on their margins ; the young silvery white. West Indies, north to the Florida Keys, the young very common at Key West and at Havana; the adult a food-fish of some importance. (*virginicus*, from Virginia, but the species does not range so far to the northward.)

*Piracoaba*, Marcgrave, Hist. Nat. Brazil, 176, 1648, Brazil.

*Polynemus virginicus*, Linnæus, Syst. Nat., Ed. x, 317, 1758, America; Jordan, Proc. U. S. Nat. Mus., 118, 1884; Jordan, Proc. U. S. Nat. Mus., 36, 1886.

*Polydactylus plumierii*, Lacépède, Hist. Nat. Poiss., v, 419, 1803, Martinique, from a drawing by Plumier.

*Polynemus plumierii*, Günther, Cat., ii, 321, 1860; Jordan & Gilbert, Synopsis, 413, 1883.

*Trichidion plumieri*, Gill, Proc. Ac. Nat. Sci. Phila., 279, 1861; Poey, Synopsis, 387, 1868.

*Polynemus mango*, Lacépède, Hist. des Poiss., v, 413, 417, 418, 1803, America; based on *P. virginicus*, Linnæus.

*Polynemus americanus*, Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 393, 1829, San Domingo (Coll. Ricord); Martinique (Coll. Plée).

*Polynemus oligodon*,* Günther, Cat., ii, 322, 1860, Rio Janeiro.

### 1209. POLYDACTYLUS OCTONEMUS (Girard).

Head 3½; depth 3⅓. D. VIII–I, 12 or 13; A. III, 13 to 15; scales 6–70–10. Maxillary less than ½ length of head; pectoral filaments 8; body somewhat compressed, elongated, anterior profile nearly straight, little declined. Head much compressed, gape oblique; snout 5 in head; eye less than interorbital space, 4½ in head. Scales rather small. Longest dorsal spine 1¼ in head; longest ray of soft dorsal 1⅗ in head; caudal lobe slightly longer than head, 3¼ in body; pectoral fins 1⅕ in head; pectoral filaments 8, reaching to vent in adult (*octofilis*), longer in young (*octonemus*). Color light olivaceous, tinged with dark punctulations; belly whitish; pectoral black in adult, pale in young. South Atlantic and Gulf Coast of the United States, from New York to the Rio Grande on sandy shores; scarce; an adult specimen corresponding to *octofilis* was taken by Dr. Gilbert at Charleston, S. C., where it is very rare, entirely unknown to the fishermen. Along the Texas Coast the young are more common, these corresponding to the description of *octonemus*. *Octofilis* is probably the adult form of *Polydactylus octonemus*, from which it differs only in having darker pectoral fins and shorter pectoral filaments, differences which come with age in other species of *Polydactylus*, and no doubt in this one also. (*ὀκτώ*, eight; *νῆμα*, thread.)

*Polynemus octonemus*, Girard, Proc. Ac. Nat. Sci. Phila., 1858, 167, Brazos Santiago; Galveston; young; Günther, Cat., ii, 320, 1860; Goode & Bean, Proc. U. S. Nat. Mus., 1879, 128; Jordan & Gilbert, Synopsis, 413, 1883.

*Trichidion octofilis*, Gill, Proc. Ac. Nat. Sci. Phila., 1861, 280, New York; adult.

*Trichidion octonemus*, Gill, Proc. Ac. Nat. Sci. Phila., 1861, 280.

*Polynemus octofilis*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 590; Jordan & Gilbert, Synopsis, 413, 1883.

### 1210. POLYDACTYLUS OPERCULARIS (Gill).

Head 3½; depth 3⅔. D. VIII–I, 12; A. III, 13; scales 8–69 or 75–13. Maxillary more than ½ length of head; pectoral filaments usually 9;

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* Dr. Günther's description is as follows:
D. VIII–I, 13; A. II, 15; scales 7–70–14. Seven pectoral appendages of moderate length. Distance between root of ventral and origin of anal less than that between posterior nostril and point of operculum. The villiform teeth of palatine and pterygoid bones form a narrow band. Pectorals and top of first dorsal black.

body elongate, compressed, outline from spinous dorsal to snout slightly convex, and little declined. Head much longer than high; snout conical, 7 in head; eye rather large, about 5 in head. Scales of small size. Longest dorsal spine 1⅔ in head; longest ray of soft dorsal 1¾ in head; caudal lobes slightly longer than head; pectoral fin as long as head behind pupil; pectoral filaments 8 or 9, reaching near front of anal fin in adult. Color greenish brown above and yellowish green below. Pacific Coast of tropical America, generally common from Cape San Lucas to Panama. (*opercularis*, from the dusky blotch on the operculum, found also in most other species.)

*Trichidion opercularis*, GILL, Proc. Ac. Nat. Sci. Phila., 1863, 168, Cape San Lucas.
*Polynemus melanopoma*, GÜNTHER, Fish. Centr. Amer., 421, 1869, San Jose de Guatemala.
*Polynemus opercularis*, STEINDACHNER, Ichthyologische Beiträge, IV, 9, 1875; JORDAN & GILBERT, Bull. U. S. Fish Comm., II, 107, 111, 1882; JORDAN, Proc. U. S. Nat. Mus., 372, 1885.

## Group AMMODYTOIDEI.

### (THE SAND LAUNCES.)

This group, consisting of the single family *Ammodytidæ*, is of unknown relations. It has been usually placed among the *Ophidioid* forms, with which it agrees in the long dorsal and anal fins destitute of spines. In the character of its mouth and gill structures it resembles the *Atherinidæ* rather than the *Ophidioidei*. The ventral fins are wanting. Our knowledge of the anatomy of *Ammodytes* is still incomplete and gives no certain clue to its relationships. The family is placed by Jordan & Gilbert between the *Percesoces* and the *Scombroidei*. Knowing no better place for it we leave it next the *Percesoces*.

## Family CX. AMMODYTIDÆ.

### (THE SAND LAUNCES.)

Body elongate, compressed, covered with small cycloid scales. Head long. Mouth rather large, nearly horizontal, the lower jaw considerably projecting, its symphysis produced. No teeth in jaws. Gill openings very wide; gill membranes not united, free from the isthmus. Branchiostegals 6 to 8. Pseudobranchiæ large, lamellate. Gill rakers long and slender; gills 4, a slit behind the fourth. Opercles well developed, without spines or serratures. Eye moderate. Premaxillaries very protractile. Maxillaries long and slender. Lateral line running along side of back. Spinous dorsal absent; soft dorsal very long and low, fragile, extending from behind the head to near the base of caudal. Caudal fin small, forked. Anal similar to dorsal, but smaller. Vent inserted behind middle of body. No ventral fins. Pectoral fins inserted low. Lower pharyngeals very small, separate. No air bladder. Pyloric cœca usually 1. Genera 3, *Ammodytes*, *Hyperoplus*, and *Bleekeria*; one genus in India; species about 10. Small carnivorous fishes, swimming in large schools near the shore and burying themselves in the sand, along the coasts of northern regions. The relationships of this family, as stated above, are still obscure. It has been usually placed near the *Ophidiidæ*, but the osteology, so far as examined by us, approaches more nearly to the *Atherinidæ*, and there is no obvious affinity between *Ammodytes* and *Ophidion* or *Lycodes*. (*Ophidiidæ*, group *Ammodytina*, Günther, Cat., IV, 384–388, 1862.)

*a.* Body with many transverse, oblique folds; a longitudinal fold of skin along sides of belly; vomer unarmed. AMMODYTES, 372.

## 372. AMMODYTES (Artedi) Linnæus.

### (SAND LAUNCES.)

*Ammodytes*, (ARTEDI) LINNÆUS, Syst. Nat., Ed. x, 1758, 247, (*tobianus*).
*Argyrotænia*,* GILL, Cat. Fish. N. Am., 40, 1861, (*vittatus*).

Body elongate, lanceolate, the skin with many transverse folds running obliquely downward and backward, the small cycloid scales mostly placed in cross series between them. Lateral line concurrent with the back. A fold of the skin along each side of the belly. Vomer not armed with a bicuspid tooth. Color silvery. Vertebræ 62 or 63. One pyloric cœcum. Carnivorous fishes inhabiting sandy shores in cold regions, living in large schools, burying themselves in the sand near the tide mark. Valued as bait and useful as food for salmon and other larger fishes. The species enumerated below are very closely related and may all prove to be varieties of the European *Ammodytes tobianus*. (ἄμμος, sand; δύω, to dive.)

*a.* Dorsal fin with 62 to 67 rays; anal rays 30 or more.
  *b.* Dorsal rays 64 to 67; anal 33 to 36; lateral folds 150; head 6½. DUBIUS, 1211.
  *bb.* Dorsal rays 62; anal 31; lateral folds 160 to 182; head 4½ to 4¾; depth 10 to 12. ALASCANUS, 1212.
*aa.* Dorsal fin with 54 to 60 rays; anal rays fewer than 30.
  *c.* Dorsal rays 60; anal 28; lateral folds 125 to 130; head 4¾; depth 10. AMERICANUS, 1213.
  *cc.* Dorsal rays 54; anal 24; lateral folds 130 to 150; head 4½; depth 9. PERSONATUS, 1214.

### 1211. AMMODYTES DUBIUS, Reinhardt.

Head 6½; depth equaling length of mandible, 2½ in length of head. D. 64 to 67; A. 33 to 36. Skin with about 150 very distinct folds. Dorsal fin inserted over posterior third of pectoral. Greenland; occasionally southward to Cape Cod. (Günther); not seen by us. (*dubius*, doubtful.)

*Ammodytes dubius*, REINHARDT, Dansk. Vidensk. Selsk. Afhandl., 132, 1838, Greenland; GÜNTHER, Cat., IV, 387, 1862; JORDAN & GILBERT, Synopsis, 415, 1883.

### 1212. AMMODYTES ALASCANUS, Cope.

Head 4½ to 4⅘; depth 10 to 12; eye 1½ in snout, 5½ in head; lateral folds 160 to 182. D. 62; A. 31. Dorsal inserted above middle of pectoral. Maxillary reaching front of orbit; mandible less than depth of body. Length

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* This generic name *Argyrotænia* rests upon what seems to have been a specimen of *Ammodytes americanus* with a mutilated dorsal fin, the first seven rays appearing as small free spines.

6 to 9 inches. It is not unlikely that this form and *Ammodytes dubius* constitute one circumpolar species, from which the closely allied forms *tobianus, americanus,* and *personatus* may be separately descended in the different shores of the north temperate zone. North Pacific Coast of North America, Sitka to Aleutian Islands.

*Ammodytes alascanus*, Cope, Proc. Am. Philos. Soc., 1873, 7, Sitka; Jordan & Gilbert, Synopsis, 415, 1883.

### 1213. AMMODYTES AMERICANUS, De Kay.

(Sand Launce; Sand Eel; Lant.)

Head 4¾; depth about 10. D. 60; A. 28. Pectoral fins much longer than snout, reaching front of dorsal. Lateral folds 125–130. Depth equal to length of mandible, which is 2⅓ in head. Olivaceous above, silvery below; sides with a steel-blue stripe. Newfoundland to Cape Hatteras, abundant on sandy shores. Very close to *A. tobianus* of Europe, but apparently more slender and with the head longer.

*Ammodytes americanus*, De Kay, New York Fauna: Fishes, 317, 1842, Stratford, Connecticut; Jordan & Gilbert, Synopsis, 414, 1883.

*Ammodytes vittatus*, De Kay, New York Fauna: Fishes, 318, pl. 60, fig. 197, 1842, New York; apparently a mutilated specimen.

*Argyrotænia vittata*, Jordan & Gilbert, Synopsis, 414, 1883.

### 1214. AMMODYTES PERSONATUS, Girard.

(Sand Launce.)

Head 4½; depth 9; eye 2 in snout, 6 in head. D. 54; A. 24. Pectoral fin half length of head, reaching past the front of the dorsal. Lateral folds 130–150. Length 6 inches. Clear hyaline green; sides silvery. Sandy shores of the north Pacific from Alaska to Monterey; very abundant northward, burying itself in the sand; perhaps a variety of *Ammodytes tobianus*; an excellent panfish, the flesh delicious. (*personatus*, masked.)

*Ammodytes personatus*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 137, Cape Flattery; Jordan & Gilbert, Synopsis, 415, 1883.

## Group BERYCOIDEI.

(The Berycoid Fishes.)

Body naked or variously scaly, the scales sometimes highly specialized; dorsal fin with few or many spines; ventral fins thoracic or subabdominal, each with 1 spine, usually 7 soft rays, the number of soft rays varying from 5 to 10; in one family (*Monocentridæ*) the spine greatly enlarged and the number of rays reduced; head with conspicuous mucous cavities; air bladder in some species retaining its duct through life, (a character verified only in *Beryx*); vertebræ in species examined, 24 to 30. Shoulder girdle and pharyngeals normal. No suborbital stay. A varied group, allied to the *Percoidei* and *Scombroidei*, but characterized as a whole by the retention of the archaic characters of the persistent air duct and the increased number of ventral rays. In the deep-sea forms the spinous dorsal is scarcely developed and the scales are usually either cycloid or wanting. In the species of tropical shores the spinous armature of fins and scales is better developed than in most of the Percomorphous fishes. The group is a very old one in geologic time, the allies of *Beryx* being among the earliest spiny-rayed fishes known. All are marine fishes, inhabiting the tropical shores or the abysses of the ocean. The pertinence of the *Polymixiidæ* and *Mullidæ* to this group is questionable.

### Families of BERYCOIDEI.

*a.* Chin without barbels; ventral rays I, 5 to I, 10; branchiostegals 7 or 8.

*b.* Dorsal fin short, single, without spines; ventrals small; subjugular, of 1 spine and 5 soft rays; branchiostegals 7. BATHYCLUPEIDÆ, CXI.

*bb.* Dorsal fin single, with 2 to 8 slender, graduated spines. Anal spines I to IV; branchiostegals 7 or 8.

*c.* Ventral fins subabdominal, each with 1 spine and 5 soft rays. STEPHANOBERYCIDÆ, CXII.

*cc.* Ventral fins thoracic, of 1 spine and about 7 soft rays, (I, 6 to I, 10).

*d.* Suborbitals very broad, covering the cheeks. TRACHICHTHYIDÆ, CXIII.

*dd.* Suborbitals narrow, not covering the cheeks. BERYCIDÆ, CXIV.

*bbb.* Dorsal fin deeply notched, its anterior division with many strong spines; anal with 4 stout spines; the third much enlarged; bones of head nearly all serrated or spinous; branchiostegals 8. HOLOCENTRIDÆ, CXV.

*aa.* Chin with 2 long barbels, attached just behind symphysis of lower jaw; branchiostegals 4; families of uncertain relationship.

*e.* Ventral rays I, 7 or I, 6. Dorsal fin single, continuous, with 5 spines; anal spines 3 or 4. Scales moderate, ctenoid; body deep, compressed; vertebræ 29. POLYMIXIIDÆ, CXVI.

*ee.* Ventral rays I, 5; dorsal fins 2, well separated, both short, the first of 6 spines; anal spines 1 or 2; scales large, slightly ctenoid; body rather elongate, the profile parabolic ; vertebræ 24. MULLIDÆ, CXVII.

## Family CXI. BATHYCLUPEIDÆ.

A pneumatic duct to air bladder; ventradiform body, cycloid scales, straightish lateral line, flattish excavated crown, long intermaxillaries extending as far back as the supramaxillaries; short postmedian dorsal without spines; long anal with one spine, and small, subjugular ventrals with a spine and 5 rays each. This family shares with the Berycoideans a persistent pneumatic duct. (Gill.) Branchiostegals 7. One genus and two species, in the deep seas. The genus *Bathyclupea* was placed by Alcock among the *Clupeidæ*, the thoracic position of the ventrals and the shortened abdominal region being regarded by him as a feature of degradation. The species bear, in fact, considerable resemblance to *Ilisha* and *Opisthopterus*. (*Bathyclupeidæ*, Gill, in Goode & Bean, Oceanic Ichthyology, 190, 1895.)

### 373. BATHYCLUPEA, Alcock.

*Bathyclupea*, ALCOCK, Ann. and Mag. Nat. Hist., VIII, 1891, 130, (*hoskyni*).

Head and body compressed ; head with large mucous cavities ; lower jaw prominent. Small, villiform teeth on jaws, palatines, and vomer.

Gill openings large. Branchiostegals 7. Pseudobranchiæ present, large. Scales cycloid, deciduous. Lateral line distinct, nearly straight. Dorsal fin postmedian, with 1 or 2 spines and 8 or 10 rays. Pectorals large, pointed, the upper rays the longest. Ventrals subjugular, small. Caudal furcate. The type, *Bathyclupea hoskyni*, Alcock, was obtained from the Andaman Sea by the *Investigator* at a depth of 188 to 220 fathoms. The largest specimen known is 8 inches in length. (*βαθύς*, deep; *Clupea*, herring.)

### 1215. BATHYCLUPEA ARGENTEA, Goode & Bean.

Head 3; eye 2⅔; snout 1½ in eye, or ½ in interorbital width. D. 9; A. 30; V. 6; scales 35. Head and body compressed; the body covered with large, cycloid, deciduous scales. Height of body at vent less than length of head, equal to distance from posterior margin of orbit to end of lower jaw. Eye slightly greater than distance from its anterior margin to tip of lower jaw. Mouth subvertical; length of upper jaw slightly exceeding diameter of orbit. Teeth in villiform bands on jaws, palatines, and vomer. Dorsal fin placed at a distance from tip of snout equal to twice height of body; its first ray inserted in vertical from base of seventh anal ray. Pectoral slender, its upper rays the longest, extending considerably beyond the origin of the anal. Ventrals small, fan-shaped, inserted almost under the posterior margin of the orbit. Color yellowish silvery. One specimen, 13 inches in length, obtained by the *Blake* at station 37, off Neris, at a depth of 365 fathoms. (Goode & Bean.) (*argenteus*, silvery.)

***Bathyclupea argentea*, GOODE & BEAN, Oceanic Ichthyology, 190, 1895, off Neris.**

## Family CXII. STEPHANOBERYCIDÆ.

Body oblong, compressed, with scales of peculiar form, circular, having in the center of each one or two erect, conspicuous lines, and in arrangement scarcely imbricated. Head large, thick, oblong, cavernous, with short convex snout, and with thin osseous ridges, especially an inner U-shaped one on the crown, whose limbs diverge on each side of the nape; also an outer sigmoid ridge on each side above the eyes, continuous with a similar ridge projecting from the nasal bone, the inner and outer ridges being connected by a cross ridge opposite the anterior margin of the orbit. Mouth very wide and somewhat oblique. Lower jaw slender and slightly projecting. Maxillaries large; premaxillaries protractile; suborbitals narrow. Teeth small, in a single band on the intermaxillaries and dentaries; palatine toothless. Bones of the head usually serrated. Branchiostegals 7 or 8; gill membranes separate, 3; gills 4, a slit behind the fourth. Pseudobranchiæ present. Gill rakers moderate. A single dorsal. Dorsal and anal without spinous rays. Ventral fins abdominal, farther back in the adult than in the young, with 1 spine and 5 rays. (Goode & Bean.) One genus, with two species, found in the deep seas. (*Stephanoberycidæ*, Gill, Standard Natural History, III, 1885, 182.)

## 374. STEPHANOBERYX, Gill.

*Stephanoberyx*, GILL, Proc. U. S. Nat. Mus., 1883, 258, (*monæ*).

Berycids with an elongated claviform contour; body covered with cycloid scales, scarcely imbricated, and armed about the center with one or two erect spines; an oblong head, with a moderate convex snout and with thin osseous ridges, especially an inner V-shaped one on the crown, whose limbs diverge on each side of nape, and an outer sigmoid one on each side, above the eyes, and continuous with one projecting from the nasal; the inner and outer ridges connected by a crossbar on a line with the anterior margin of the orbit; rather small eyes, in the anterior half of the head, and the teeth small, acute, and in a band on the premaxillaries and dentaries (palate toothless), and with ventrals having 1 spine and 5 rays. Deep sea. (*στέφανος*, crown; *Beryx*.)

*a.* Dorsal and anal each with 13 or 14 rays. MONÆ, 1216
*aa.* Dorsal and anal each with 11 rays. GILLII, 1217

### 1216. STEPHANOBERYX MONÆ, Gill.

Head 3; depth 3½. D. 14; A. 13 or 14; P. 10; V. I, 5. Eye 4½ in head and nearly equal to snout; upper jaw slightly longer than postorbital part of head. Gill rakers long and slender, about 25 below the angle; distance of anal origin from end of head equal to ⅔ length of head; ventrals originating under middle of pectorals. Color brownish. One specimen, 2 inches long, obtained by the *Albatross* from station 2077, at a depth of 1,255 fathoms. (Goode & Bean.) (Named for Mona Gill, niece of Dr. Gill.)

*Stephanoberyx monæ*, GILL, Proc. U. S. Nat. Mus., 1883, 258, Gulf Stream. (Type, No. 33445. Coll. Albatross.) GOODE & BEAN, Oceanic Ichth., 186.

### 1217. STEPHANOBERYX GILLII, Goode & Bean.

Head 3; depth 3½; eye 4; snout 4. D. 11; A. 11; P. 13; V. I, 5; B. 7; scales 9–33–7. Upper jaw as long as postorbital part of head; gill rakers long and slender, about 15 below the angle on first arch. Origin of ventrals behind end of pectorals; distance of anal origin from end of head fully equals length of head. Color in spirits pale, the back in front of dorsal showing traces of rose. Length 4¾ to 6 inches. Gulf Stream, at different stations in about 1,200 fathoms. (Goode & Bean.) (Named for Theodore Gill.)

*Stephanoberyx gillii*, GOODE & BEAN, Oceanic Ichthyology, 187, fig. 206, 1895, Gulf Stream. (Type, No. 33555 Coll. Albatross.)

## Family CXIII. TRACHICHTHYIDÆ.

Body ovate, deep, much compressed, with small ctenoid scales. Abdomen protected by a dermal scute which forms a serrated edge. Head large, deeper than long; superficial bones excavated and with conspicuous muciferous cavities. Mouth very wide, oblique; villiform teeth in jaws and sometimes on vomer. Suborbitals very broad, covering the cheeks. Branchiostegals 8. Gill openings very wide, the gill laminæ very short.

One dorsal fin, short, with a few spines in front. Ventral rays I, 6. Deep-sea fishes, allied to the *Berycidæ*, 2 genera and 10 species known. (*Trachichthyidæ*, Goode & Bean, Oceanic Ichthyology, 187, 1895.)

*a.* Vomer toothless; opercle entire; anal spines 3. HOPLOSTETHUS, 375.

### 375. HOPLOSTETHUS, Cuvier & Valenciennes.

*Hoplostethus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IV, 469, 1829, (*mediterraneus*).

Body short and deep, much compressed. Head short, compressed, very blunt anteriorly, deeper than long, with very conspicuous mucous cavities. Eye very large. Mouth very oblique, the jaws equal when the mouth is closed. Maxillary long, broad behind, with a distinct supplemental bone, which reaches the posterior border of the eye. Teeth very fine, villiform, on jaws and palatines, none on the vomer. Suborbital with radiating ridges and a few spines; a vertical ridge on the front of the opercle. Opercle little developed, its spine small or obsolete; a strong spine at the angle of the preopercle; the long vertical limb of the preopercle finely serrated. Gill membranes separate, free from the isthmus. Branchiostegals 8. Scales moderate or small, ctenoid; lateral line present, its scales enlarged; abdomen with a series of bony plates, each ending in a retrose spine. Dorsal fin continuous, short, the spines graduated, 6 in number; anal with 3 graduated spines; caudal forked, its rudimentary rays spinous; pectorals low, rather long; ventrals I, 6, rather short. Air bladder simple. Pyloric cœca numerous. Vertebræ 11 + 15. Deep-sea fishes. Red in color. (ὅπλον, armor; στῆθος, breast.)

#### 1218. HOPLOSTETHUS MEDITERRANEUS, Cuvier & Valenciennes.

Head $2\frac{1}{2}$; depth $1\frac{4}{5}$; eye very large, much longer than snout, about 3. D. VI, 12 to 15; A. III, 8 to 11; scales 28 to 31. Abdominal serræ 9 to 13 in number. Body above with very small roughish scales; sides nearly or quite naked (in the young example seen), scaly in the adult. Pectorals reaching first soft ray of anal; ventrals to vent; fins rather low. Silvery, rosy in life; fins scarlet; peritoneum and inside of mouth black. Coasts of southern Europe, in deep water; numerous specimens taken in the Gulf Stream by the *Albatross* and *Fish Hawk* in about 200 fathoms. Also found in Japan, if *H. japonicus* is the same species, as Dr. Günther has supposed.

*Hoplostethus mediterraneus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IV, 469, 1829, Mediterranean Sea; GÜNTHER, Cat., I, 9, 1859; JORDAN & GILBERT, Synopsis, 458, 1883; GOODE & BEAN, Oceanic Ichthyology, 181, 1895.

*Trachichthys pretiosus*, LOWE, Proc. Zoöl. Soc. Lond., 1839, 77, Madeira.

? *Hoplostethus japonicus*, HILGENDORF, Sitz. Ges. Naturforschende Freunde, Berlin, 78, 1879, Japan; apparently a variety or species with slightly smoother scales.

## Family CXIV. BERYCIDÆ.

### (THE BERYCOIDS.)

Body oblong or ovate, compressed, covered with ctenoid or cycloid, foliate or granular scales. Head with large muciferous cavities, covered by thin skin. Eye lateral, usually large. Mouth wide, oblique. Premaxillaries protractile; maxillary rather large, usually with a supplemental bone. Suborbitals narrow, not sheathing the cheeks. Bands of villiform teeth on jaws, and usually on vomer and palatines; canines sometimes present. Opercular bones usually spinous. Branchiostegals 7 or 8. Gill membranes separate, free from the isthmus. Gills 4, a slit behind the fourth. Pseudobranchiæ present. Gill rakers moderate. Cheeks and opercles scaly. No barbels. Dorsal fin continuous, with 2 to 8 weak spines; anal with 2 to 4 spines; ventral fins thoracic, mostly I, 7, the number of rays usually greater than I, 5; caudal fin usually forked. Pyloric cœca numerous. Genera 6 or 8; species about 40. Fishes mostly of the deep seas; the general color red or black. This group is an ancient type, a great number of extinct species being now known. (*Berycidæ*, Günther, Cat., I, 8–50, 1859, exclusive of certain genera.)

ANOPLOGASTRINÆ:
- *a.* Scales small, granular or leaf-like; teeth unequal; palatines toothless; mouth very wide and oblique.
  - *b.* Scales leaf-like, pedunculated; teeth villiform, with two pairs of long fang-like teeth above, and three below. CAULOLEPIS, 376.
  - *bb.* Scales reduced to minute asperities; teeth villiform, some of those in the lower jaw enlarged. ANOPLOGASTER, 377.

MELAMPHAINÆ:
- *aa.* Scales cycloid; teeth villiform, none on palatines; head large and thick.
  - *c.* Teeth small, cardiform; lower jaw projecting; scales thin; body short, compressed. POROMITRA, 378.
  - *cc.* Teeth in villiform bands; scales large; spinous dorsal short.
    - *d.* Anal inserted under last rays of dorsal; anal with one spine; dorsal with three. PLECTROMUS, 379.

BERYCINÆ:
- *aaa.* Scales ctenoid; teeth villiform on jaws, palatines, and vomer.
  - *e.* Muzzle short; chin projecting; preopercle spineless; opercles serrated; anal rays IV, 26 to 30; ventrals, I, 10. BERYX, 380.

## 376. CAULOLEPIS,[*] Gill.

*Caulolepis*, GILL, Forest and Stream, XXI, August 30, 1883, and in Proc. U. S. Nat. Mus., VI, 1884, 258, (*longidens*).

Contour laterally oval or broad pyriform, the body compressed, covered with small, pedunculated, leaf-like scales; forehead abruptly declivous;

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[*] Dr. Gill (in Goode & Bean, Oceanic Ichthyology), adds the following details:

Body compressed, pyriform, highest in front, and with the dorsal and inferior outlines converging to caudal peduncle, which is moderately long and slender. Scales small and not or scarcely imbricated, upraised by peduncles, and with the surface extended and dentate behind. Lateral line distinct and developed as a groove running parallel with the back and continuous to the base of the caudal fin. Head higher than long, with the cranial portion very declivous, and with the suspensorial portion obliquely extended downward and backward; the cranium above with three naked membranous areas, an anterior pair pointed forward and diverging to receive the ascending process of the intermaxillaries and a median hastiform one behind; also with a naked horseshoe-shaped area around the nape, the naked spaces being separated by the bony bars limiting the large muciferous cavities; suborbital bones enlarged, sculptured, and with small, erect spines; the first with three radiating bars; the second largest, sending four depending processes, three forward or downward, and another articulating with the preoperculum above its angle; the postorbital expanding distally and articulating with the preoperculum above; the interspaces covered by a tense skin with the extension of the scales embedded in it. Preoperculum angulated downward and backward, spinigerous at the angle and with no horizontal lines; opercular apparatus much reduced; the operculum extended downward, with eyes small; a pair of very long, pointed teeth in front of upper jaw, closing in front of lower; a similar pair of still longer pointed teeth in the lower, received in foveæ of the palate; on the sides of each jaw two long teeth terminating in bulbous tips; a row of minute teeth on the posterior half of the supramaxillaries; palate toothless. One species. (*καυλός*, stem; *λεπίς*, scale.)

### 1219. CAULOLEPIS LONGIDENS, Gill.

D. II, 17; A. II, 8; C. x–19–x; P. I, 14; V. I, 7. Head 2⅘; depth of body ½ its length inclusive of caudal; upper jaw from symphysis to end of maxillary contained 3½ times in total length. Orbit 4 times in length of head. Front teeth of upper jaw considerably longer than eye; those of the lower nearly twice as long. Scales very peculiar, foliaceous and pedunculate. Color uniform black. One specimen from Gulf Stream. (Goode & Bean.) (*longus*, long; *dens*, tooth.)

*Caulolepis longidens*, Gill, Proc. U. S. Nat. Mus., 1883, 258, Atlantic Ocean, latitude 39° 27′, longitude 69° 56′ 20″, in 1,346 fathoms. (Type, No. 33270. Coll. Albatross); Goode & Bean, Oceanic Ichthyology, 185, fig. 204, 1895.

## 377. ANOPLOGASTER, Günther.

*Anoplogaster*, Günther, Cat. Fish. Brit. Mus., I, 12, 1859, (*cornutus*).

Body compressed, deep, with the scales reduced to minute asperities. Head large, with thin bones and wide muciferous cavities. Cleft of mouth wide and oblique; chin prominent. Muzzle short, rounded, not protruding. Teeth in villiform bands in the jaws, with several larger teeth in the lower jaw; palatine toothless. Eye large. Preoperculum entire. Suprascapula and angle of preoperculum armed with a spine. Dorsal without spines and with about 17 rays. Anal with 9 or 10 rays. Ventral with 1 spine and 6 rays. Air bladder small, pyriform. Branchiostegals 8. Gill openings very wide. (*ἄνοπλος*, unarmed; *γαστήρ*, belly.)

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numerous striæ and ridges and with three more diverging ridges extended backward or downward into spiniform angles, one horizontal and the others oblique, leaving emarginated interspaces between; the interopercula and subopercula small, the latter with several striæ pointed backward.

Eye moderately developed, near the anterior profile. Upper jaw not protractile, with the premaxillaries extended far backward and the supramaxillaries lying behind and above, and with wide oval extremities furnished with radiating ridges or striæ.

Lower jaw quite deep, with an upper and lower portion longitudinally striated and an intermediate region provided with a naked skin, and with its angle emitting a spine backward; chin flattened backward to a median inferior point; teeth enlarged and few, in a single row in each jaw. (1) In the upper a pair slightly curved and regularly pointed, closing in front of lower jaw, and on each side two at intervals, behind much smaller and with swollen blunt tips. (2) In the lower jaw a pair near the symphysis more separated than those of the upper and fitting into foveæ of the palate on each side; two smaller teeth nearly straight and with globular points, the first intermediate between the first and second of the upper, and the second behind the second lateral tooth of the upper jaw; palate and tongue edentulous. (3) A row of very small teeth around the posterior half of the supramaxillary.

Dorsal single, commencing above the upper axil of the pectoral, with 2 spines and 17 bifurcate rays, the last of which is double; anal short, mostly behind the dorsal, with 2 spines, the first very short, and 8 bifurcate rays, the last double; caudal deeply emarginated, but with rounded lobes; pectorals obliquely inserted, of moderate size, with 1 simple and about 14 branched rays; ventral fins subabdominal or decidedly behind the pectorals, with 1 spine and 6 branched rays. Branchial apertures deeply cleft; branchiostegal rays 8.

### 1220. ANOPLOGASTER CORNUTUS (Cuvier & Valenciennes).

Head 2¾; depth about 1¾; eye about 3. D. 17; A. 9 or 10; P. 16; V. 7. Interorbital width nearly half that of head; suborbital arch with 7 cavities; bony ridges of head ending in several blunt points; ventrals midway between tip of snout and base of caudal. Deep Atlantic, five specimens known, one of them from 39° 18′ 30″ N., 68° 24′ W., obtained by the *Albatross*. (Goode & Bean.) (*cornutus*, horned.)

*Hoplostethus cornutus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IX, 270, 1833, stomach of an Albicore, 31° N., 40° W.

*Anoplogaster cornutus*, GÜNTHER, Cat., I, 12, 1859; GOODE & BEAN, Oceanic Ichth., 184, 1895.

## 378. POROMITRA, Goode & Bean.

*Poromitra*, GOODE & BEAN, Bull. Mus. Comp. Zoöl., 1882, 214, (*capito*).

Body short, compressed, scopeliform, covered with thin cycloid scales. Head very large (in young specimens nearly as long as trunk) its sides scaly. No barbel. Mouth very large, the lower jaw projecting. Margin of upper jaw composed of a long maxillary and a short premaxillary. Teeth very small, cardiform, on premaxillaries and lower jaw only. Opercula complete. Dorsal fin in middle of body, its origin not far behind ventrals, its spinous and soft portions about equal in length; anal much shorter than dorsal; the last rays of dorsal nearly above its middle. Pseudobranchiæ present. Gill openings very wide. Deep seas. (*πορός*, pore; *μίτρα*, stomacher.)

### 1221. POROMITRA CAPITO, Goode & Bean.

Head 2½ (in young); depth 3½. D. VII or VIII, 6; A. 9; V. 7 or 8; P. 12; C. 5. Eye large, as long as snout; maxillary 3½ in head. Scales as large as pupil, with concentric striæ, about 24 in lateral line and 10 in transverse series. Insertion of dorsal midway between tip of snout and base of caudal; base of anal half that of dorsal; pectoral inserted low, its length twice its distance from the snout; ventrals minute, in advance of pectorals. Caudal (mutilated in the known specimens). Gulf Stream in latitude 34°, obtained by the *Blake*. (Goode & Bean.) (*capito*, large-headed.)

*Poromitra capito*, GOODE & BEAN, Bull. Mus. Comp. Zoöl., 215, 1882, Gulf Stream; GOODE & BEAN, Oceanic Ichth., 183, 1895.

## 379. PLECTROMUS,[*] Gill.

*Plectromus*, GILL, Proc. U. S. Nat. Mus., 1883, 257, (*suborbitalis*).

Body moderately elongate, covered with moderate cycloid scales. Head large and thick, with wide muciferous channels, the bones often with

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[*] The following details concerning *Plectromus* are given by Dr. Gill (Goode & Bean, Oceanic Ichthyology, 178):

Body little compressed, highest behind ventrals, with the dorsal outline describing a slight sigmoidal curve and the abdominal almost rectilinear; the caudal peduncle long and robust. Scales moderate, imbricated, cycloid, and readily deciduous. Lateral line apparently undeveloped. Head oblong or longer than high, very declivous in front, and with the suspensorium foliaceous expansions; opercles unarmed. Mouth moderate, oblique, the jaws subequal. Teeth villiform, mostly in two rows, the inner row largest; palate toothless. One dorsal, with 2 or 3 spines and 10 to 16 rays. Anal inserted below last rays of dorsal, with 1 spine and 8 or 9 rays. Ventrals thoracic, with 7 rays. Caudal forked. Deep sea. Very close to *Melamphaës*, from which it chiefly differs in possessing 2 or 3 dorsal spines instead of 6. Perhaps the two groups should be merged in one, as has been done by Günther and Gilbert. (*πλῆκτρον*, spur; *ὦμος*, shoulder; "two spines, one on each side of the nape, springing forward from the shoulder bones, give a strange appearance to the fish.")

*a.* Dorsal rays III, 15 or III, 16.
  *b.* Nape with a spine on each side, springing from the shoulder bones. SUBORBITALIS, 1222.
  *bb.* Nape without spine as above; bones of head firm, without papery expansions; maxillary reaching vertical from posterior margin of eye. LUGUBRIS, 1223.
*aa.* Dorsal rays II, 11 to 13.
  *c.* Head 3 in length; pectoral nearly or quite as long as head. BEANII, 1224.
    *d.* Eye large, $4\frac{1}{2}$ in head.
    *dd.* Eye small, 7 in head. CRASSICEPS, 1225.
  *cc.* Head $2\frac{3}{5}$ in length; pectoral $1\frac{1}{3}$ in head; head with high thin crests above; snout with a slender spine; eye small, $7\frac{1}{2}$ in head. CRISTICEPS, 1226.

### 1222. PLECTROMUS SUBORBITALIS, Gill.

Head 3; depth $2\frac{2}{3}$. D. III, 16; A. I, 8; P. 14; V. I, 7; scales about 30–6; the exposed margins of the few scales present marked with coarse concentric striæ. Eye as long as snout and $5\frac{1}{2}$ times in head. Mouth oblique; end of maxillary reaching to below hind margin of orbit. Two spines, one on each side of the nape, springing forward from the shoulder bones. Mandible projecting slightly. Gill membranes deeply cleft, free from the isthmus behind; gill rakers moderate, about 15 below angle of first arch. A single series of weak, somewhat scattered, curved teeth on the intermaxilla and mandible. Dorsal origin over the sixth row of scales; length of dorsal base equal to head. Anal origin under seventeenth ray of dorsal; anal base nearly $\frac{1}{3}$ as long as head. Pectoral $3\frac{1}{2}$ in body; ventral inserted under base of pectoral. Color black. The type of the species, $3\frac{9}{16}$ inches long without the caudal, was obtained by the *Albatross* from Station 2036, at a depth of 1,735 fathoms. Another (No. 35451, U. S. Nat. Mus.) was

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almost vertical; the cranium above with a naked skin extending from the nape forward to the nasal region, covering large muciferous cavities separated by osseous bars and with lateral crests simulating those of crested Scorpænids. Suborbital bones with the superficial area narrow and emitting sulcate spiniform processes; cheeks covered with skin as well as periorbital region. Preoperculum with its inner fold parallel with, but widely separated from, the external margin; the latter is rounded at the angle, the posterior limb is vertical, and a short horizontal one is developed. Operculum normally developed, with large cycloid scales, and, behind, radiating ridges; suboperculum extending as a membranous border behind; interoperculum moderate. Eye moderate (its diameter equaling a quarter of the head's length) and entirely in the anterior half of the head. Mouth with the cleft moderately oblique. Upper jaw not protractile; the intermaxillaries protracted backward almost as far as the supramaxillaries; the latter have normally dilated smooth ends. Lower jaw quite deep, curved, with smooth skin, with the rami inclined inward below and nearly contiguous, and with a truncate chin. Teeth rather small, curved, and pointed, in two rows in each jaw, those of the upper closing around the lower jaw, and the teeth of the external row (at least in the lower jaw) smaller than those of the internal. Branchial apertures normally cleft. Shoulder girdle emitting a spine on each side, behind the nape.

taken from Station 2190, at a depth of 1,800 fathoms; also two small individuals from Station 2535, at a depth of 1,149 fathoms. (Goode & Bean.) (*sub*, below; *orbĭtus*, orbit.)

*Plectromus suborbitalis*, GILL, Proc. U. S. Nat. Mus., VI, 1883, 258, latitude 38° 52′, longitude 69° 24′, 1,735 fathoms. (Type, No. 33271. Coll. Albatross); GOODE & BEAN, Oceanic Ichth., 179, fig. 201, 1895.

### 1223. PLECTROMUS LUGUBRIS (Gilbert).

D. III, 15; A. I, 8; scales 26. Head very broad and heavy, the snout extremely broad and short, its anterior profile nearly vertical. Mouth very oblique, the lower jaw protruding beyond the upper, the premaxillaries anteriorly on level of lower margin of pupil, the maxillary reaching vertical from its posterior margin, 2⅗ in head; snout 4½, its width equaling the length of snout and eye; interorbital width 2⅗; eye 6½. Teeth minute, uniform, in a single series in upper jaw and in front of mandible, the lower jaw laterally with a narrow band. Vomer and palatines toothless. Interorbital space strongly convex, as well as rest of head deeply excavated for mucous canals, which are covered with a very delicate integument conspicuously marked with fine parallel or radiating striæ. Bones firm and cartilaginous, not papery nor with thin membranous expansions as in other related species. Margins of preopercle entire, the bone firm, the posterior angle scarcely produced, evenly rounded, the margin nearly vertical. No evident ridge on opercle, which terminates posteriorly in a flexible rounded process without spine. Mandibles meeting along median line posteriorly, but not forming a ridge. Gill rakers as long as eye, slender, about 14 below angle. Dorsal spines very weak, the third half as high as first soft ray. Posterior line of occiput midway between tip of snout and origin of dorsal. Base of dorsal equals length of head behind middle of eye. Anal small, its origin under base of last dorsal ray, the length of its base equaling half interorbital width; spine slender, about ⅔ longest soft ray; pectorals long, slender, falcate, with 14 rays, the longest $1\frac{2}{7}$ in head. Ventrals half head, not reaching vent. Scales large, caducous, with entire edges, covering the opercles but lacking elsewhere on head. Uniform brownish black, the fins dusky; mouth, gill cavity, and peritoneum black. A single specimen, 3½ inches long, from *Albatross* station 2923, in 822 fathoms. This species resembles very closely *M. typhlops*, as figured by Günther (Deep-sea Fishes, *Challenger*, Pl. V, Fig. A). In *typhlops* the mouth is evidently larger, and the species is described as having 6 dorsal spines and 11 rays, although the artist has represented it with D. III, 14. (Gilbert.) (*lugubris*, sorrowful, dark.)

*Melamphaës lugubris*, GILBERT, Proc. U. S. Nat. Mus., 1890 (1891), 59, *Albatross* station 2923, coast of California, south of Point Concepcion, in 822 fathoms. (Coll. Albatross.)

### 1224. PLECTROMUS BEANII (Günther).

Head 3; depth 3½; eye 4½. D. II, 11 or 12; A. I, 8 or 9; V. I, 7; P. 15; scales about 25. Pectoral as long as head, more than twice length of ventral, which does not reach vent. Black. (Bean.) Gulf Stream in deep water. (Named for Tarleton Hoffman Bean.)

*Plectromus crassiceps*, BEAN, Proc. U. S. Nat. Mus., 1885, 73, Gulf Stream. (Type, Nos. 33378, 33509, and 34835. Coll. Albatross); about latitude 40°; not *Scopelus crassiceps*, GÜNTHER, Ann. Mag. Nat. Hist., 1878, 185, also a *Plectromus*.

*Melamphaës beanii*, GÜNTHER, Deep-sea Fishes, *Challenger* Report, XXII, 29, 1887; after BEAN.

*Plectromus beani*, GOODE & BEAN, Oceanic Ichthyology, 179, 1895.

### 1225. PLECTROMUS CRASSICEPS, Günther.

Head 3; depth 4. D. III, 12; A. I, 9; P. 14; V. I, 7; scales 28. Least depth of tail ⅖ of its free portion. Head very thick, with short snout. Eyes small, ⅐ length of head, and ½ of that of snout; posterior margin of preoperculum descending obliquely backward; lower jaw slightly prominent; cleft of mouth rather oblique; maxillary reaches to behind eye, and is moderately dilated behind. Origin of dorsal fin nearer the ventrals; its last ray is above the anterior anal rays. Pectoral fin narrow, nearly as long as head, reaching to or beyond end of anal fin. Black. Length 2½ inches. Two specimens known, one from the mid-Atlantic (1,500 fathoms), the other from off Pernambuco. (Günther.) (*crassus*, thick; *-ceps*, head.)

*Scopelus crassiceps*, GÜNTHER, Ann. Mag. Nat. Hist., II, 1878, 185, deep sea, mid-Atlantic, and off Pernambuco.

*Melamphaës crassiceps*, GÜNTHER, *Challenger* Report, XXII, 28, Pl. VIII, Fig. B, 1887.

*Plectromus crassiceps*, GOODE & BEAN, Oceanic Ichthyology, 180, 1895.

### 1226. PLECTROMUS CRISTICEPS (Gilbert).

Head long, 2⅗ in length; depth 3⅗; length of caudal peduncle 4⅕. Greatest depth of caudal peduncle ½ its length. Head narrower than in *M. lugubris*, its anterior profile descending more gradually. Mouth less oblique, the lower jaw included, the maxillary extending behind eye, 2¼ in head; snout 4⅓; interorbital width 2⅘; eye 7½. D. III, 13; A. II, 9. Pectorals long, 1⅓ in head. Ventrals I, 7 or I, 8. System of mucous canals on head highly developed, their margins raised into high thin crests, usually with undulating margins and more or less serrulated. A rather long, sharp, slender spine, directed upward and forward on middle of snout. Two or three spines at lower posterior angle of cheek; marginal portion of preopercle extremely thin and flexible, its lower limb sharply serrated. From the upper anterior angle of opercle 2 ridges diverge, the one running backward terminating in a spinous point. Opercular margin serrulate. Mandibles meeting on median line below, their edges produced to form a conspicuous median crest. Their lateral margins form membranous wings which combine with similar prolongations from the suborbital bones to overlap the cleft of the mouth. Teeth minute, equal, in a single series in both jaws. Vomer and palatines toothless. Gill rakers long, broad at base, compressed, weak, about 15 below angle. Posterior line of occiput slightly nearer front of dorsal than end of snout; length of fin equaling its distance from base of caudal. Spines slender, pungent, weak. Origin of anal under the fourth from the last ray of dorsal, the length of its base scarcely exceeding length of snout. Anal spines rather strong, the two intimately soldered together, their outlines distinct. Scales entirely lost, apparently about 23 in number. Black anteriorly, brownish black behind. Mouth, gill cavity, and peritoneum jet black. Fins all blackish. One specimen 5 inches long, from station 3075, in 859 fathoms. (Gilbert.) (*crista*, crest; *-ceps*, head.)

*Melamphaës cristiceps*, Gilbert, Proc. U. S. Nat. Mus., 1890 (1891), 60, *Albatross* station 3075, coast of Oregon and Washington, in 859 fathoms.

## 380. BERYX, Cuvier.

(Alfonsines.)

*Beryx*, Cuvier, Règne Anim., Ed. 2, vol. ii, 151, 1829, (*decadactylus*).

Body deep, compressed, covered with rather large, ctenoid scales, which are regularly arranged. Abdomen trenchant, but without enlarged scutes. Head large, with thin bones and high ridges with deep muciferous cavities. Snout short, the mouth oblique, the chin prominent; eye large; both jaws, vomer, and palatines with villiform teeth. Opercles serrated, the opercle usually with spine; preopercle unarmed. Caudal forked; anal spines 4, the soft rays 26 to 30; dorsal continuous, with 4 to 6 spines; ventrals with about 10 soft rays. Air bladder simple. Pyloric cœca numerous. Color red. Deep-sea fishes, beautifully colored. (βέρυξ, *Beryx*, a Greek name of some fish, taken by Gesner from Varinus.)

*a.* Scales in lateral line 64 or 65; D. IV, 16 to 19. decadactylus, 1227.
*aa.* Scales in lateral line 71 to 76; D. IV, 13 to 15. splendens, 1228.

### 1227. BERYX DECADACTYLUS, Cuvier & Valenciennes.

(Alfonsin a Casta Larga.)

Head 2½; depth 2½. D. IV, 16–19; A. IV, 28–29; V. I, 10; P. 14. Body oblong, considerably compressed, its height greatest at the origin of the dorsal; maxillary bone reaches almost to middle of orbit. Eye very large, about 2½ times in head, its upper limb impinging upon upper profile of head; distance of insertion of pectoral from snout equal to length of base of anal; insertion of anal nearly in vertical from tenth to twelfth dorsal ray, its middle slightly behind last ray of dorsal; ventral inserted under axil of pectoral. Scales sharply ctenoid, with a strong middle keel; the number in the lateral line 64 or 65. Red, with bright streaks. Deep seas, recorded from Portugal, Madeira, Japan, and Cuba. Poey mentions it as "Pez hermoso y rarisimo." (δέκα, ten; δάκτυλος, finger.) (Eu.)

*Beryx decadactylus*, Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 222, 1829, Madeira or Portugal; Poey, Synopsis, 297; Goode & Bean, Oceanic Ichth., 175, 1895.

### 1228. BERYX SPLENDENS, Lowe.

(Alfonsin a Casta Cumprida.)

Body compressed, elongate, its height equal to the length of the head, and contained 3½ times in the total. Pectoral and dorsal fins, which are equal in length, ⅕ of the entire length of the fish; the ventral ⅙. Dorsal and anal fins are higher than in *B. decadactylus*; insertion of the anal is under the end of the dorsal. Caudal deeply forked. Scales large, the whole surface spinous, with short reflexed points or prickles, giving a general roughness to the touch. Lateral line nearly straight, following the curvature of the back, inconspicuous, and with 71 to 76 scales, with 8 above and 20 below the lateral line in transverse series. Its color is thus described by Lowe: "At the moment of capture, whilst this fish is yet alive, the whole body beneath the lateral line is of a pure, resplendent, silvery white; the fins alone, and merely the ridge of the back and head, the inside of the mouth, the lower jaw, and parts beneath the eye being of the brightest scarlet, contrasting strongly with the pure silver of the whole sides and belly, which only after death turn iridescent rosy, or sometimes rich golden scarlet. The hind parts of the dorsal and the ventral fins are transparent; the iris is pale scarlet. There is a watery transparency about the scarlet of the back in this state perfectly inimitable by art." Color paler than in *B. decadactylus*, but the inside of the mouth deep red. Known from Madeira, Japan, and the Gulf Stream, 34° 49′ 30″ N., 74° 34′ 45″ W., in 424 fathoms. (Goode & Bean.) (*splendens*, glowing.)

*Beryx splendens*, Lowe, Proc. Zoöl. Soc. London, 1833, 142, Madeira; Goode & Bean, Oceanic Ichthyol., 176, 1895.

## Family CXV. HOLOCENTRIDÆ.

### (The Squirrel-fishes.)

Body oblong or ovate, moderately compressed, covered with very strongly ctenoid or spinous scales. Head with large muciferous cavities; eye lateral, very large; preorbital very narrow; mouth moderate, oblique; premaxillaries protractile; maxillary very large, with supplemental bone; bands of villiform teeth on jaws, vomer, and palatines. Opercular bones and membrane bones of head generally serrated or spinescent, along their edges. Branchiostegals 8. Gill membranes separate, free from isthmus. Gills 4, a slit behind fourth. Pseudobranchiæ present. Gill rakers moderate; no barbels. Sides of head scaly. Lateral line present. Dorsal fin very long, deeply divided, with about 11 strong spines depressible in a scaly groove; anal with 4 spines, the third longest and strongest; ventrals thoracic, with 1 spine and 7 rays; caudal deeply forked, with sharp rudimentary rays or fulcra at base. Vertebræ about 27. Pyloric cœca 8 to 25. Air bladder large, sometimes connected with the organ of hearing. General color red. Young with the snout sharp and produced (constituting the nominal genera *Rhynchichthys*, *Rhamphoberyx*, and *Rhinoberyx*, based on peculiarities of immature examples). Genera 4; species about 70, gaily-colored inhabitants of the tropical seas, abounding about coral reefs. (*Berycidæ*, part, Günther, Cat., I, 19–50, 1859.)

*a.* Preopercle without conspicuous spine at its angle; air bladder divided by a contraction, the anterior part extending to the otocrane. Myripristis, 381.

*aa.* Preopercle with a conspicuous spine.

  *b.* Suborbital arch simply serrated; scales moderate, 38 to 55. Holocentrus, 382.

  *bb.* Suborbital arch armed with 3 long spines curved forward; scales undescribed. Plectrypops, 383.

## 381. MYRIPRISTIS, Cuvier.

### (Frère-Jacques.)

*Myripristis*, Cuvier, Règne Animal, Ed. 2, Vol. ii, 1829, (*jacobus*).
*Myriopristis*, Gill, amended spelling.
*Ostichthys*, Langsdorf MS., Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 174, 1829, (*japonicus*); name only; passing reference.
*Rhamphoberyx*, Gill, Proc. Ac. Nat. Sci. Phila., 1863, 87, (*pœcilopus*).

This genus is closely related to *Holocentrus*, differing externally, chiefly in the absence of the large spine at the angle of the preopercle. The air bladder is divided into two parts by a transverse constriction, the anterior part extending to the otocrane, and the pyloric cœca are rather few (9). Species numerous in the tropical seas; gay-colored inhabitants of reefs and rock pools. The group contains two well-marked subgenera, for one of which we retain the manuscript name *Ostichthys*, given it by Langsdorf some seventy years ago. If no intermediate forms exist, *Ostichthys* may stand as a distinct genus. (*μυριάς*, myriad; *πρίστις*, a sawyer, here meaning saw.)

Ostichthys (ὀστέον, bone; ἰχθύς, fish):
- *a.* Scales very large, about 3–29–7; anal rays IV, 10 or 11. trachypoma, 1229.

Myripristis:
- *aa.* Scales moderate, about 3–36–6.
  - *c.* Anal rays IV, 13; a deep red or black bar across gill opening and base of pectoral. jacobus, 1230.
  - *cc.* Anal rays IV, 11.
    - *d.* Ventral fin plain reddish or whitish; dorsal pale. occidentalis, 1231.
    - *dd.* Ventral fin black at tip; dorsal mostly dark. pœcilopus, 1232.

### Subgenus OSTICHTHYS (Langsdorf).

### 1229. MYRIPRISTIS TRACHYPOMA, Günther.

Head 2¾ in length with caudal; depth about 2⅘; interorbital width 6 in head. B. 8; D. XI–I, 13; A. IV, 10–11; V. I, 7; P. 15; C. 4–3, 25; scales 3–29–7. All the teeth villiform; the upper maxillary bone reaches behind the middle of the eye, and is not denticulated. Opercles covered with spines, and operculum with a rather strong spinous prominence; scales ctenoid, but the denticulations equal; the third anal spine much stronger and also longer than the fourth. Carmine red, darker above; sides with about 10 alternate streaks of deep red on rose color; fins all red. (Günther.) West Indies; rare in Cuba. A beautiful fish, closely related to *Myripristis japonicus*, the type of *Ostichthys*. (*τραχύς*, rough; *πῶμα*, operculum.)

*Myripristis trachypoma*, Günther, Cat., i, 25, 1859, Cuba.
*Myriopristis fulgens*, Poey, Memorias, ii, 160, 1860, Cuba.

### Subgenus MYRIPRISTIS.

### 1230. MYRIPRISTIS JACOBUS, Cuvier & Valenciennes.

### (Frère-Jacques; Candil.)

Head 4; depth 3; interorbital width 4. D. X–I, 14 or 15; A. IV, 13; scales 3–36 to 38–6. Maxillary reaching a little beyond middle of eye;

opercle striated, the striæ ending in fine points at posterior edge of opercle, above a very feeble spine. Pectorals shorter than ventrals; third and fourth anal spines nearly equal in length, the former broader. Deep crimson, paler below; a blood-red bar across opercle and base of pectoral, becoming black in spirits; fins red, the vertical fins edged with whitish. Length 1 foot. West Indies to Brazil; common; a brilliantly colored fish. (*Jacobus*, James; the species is called Frère-Jacques, "brother Jim." in Martinique.)

*Myripristis jacobus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., III, 162, 1829, Martinique; GÜNTHER, Cat., I, 19, 1859.

*Myripristis lychnus*, POEY, Memorias, II, 159, 1860; Havana.

*Rhinoberyx chryseus*, COPE, Proc. Amer. Philos. Soc., 464, 1870, St. Croix Island.

### 1231. MYRIPRISTIS OCCIDENTALIS, Gill.

Head 3⅓ in extreme length; depth nearly 4; eye 2½; snout 5. D. X–I, 13; A. IV, 11; scales 3–35 or 36–7; pectoral fin contained 6 times in the total length, the ventrals 7½, and the caudal 5 times. Color on the upper half reddish purple, silvery below, with many dark points, especially along edges of scales; fins pale, except a darker border along spinous dorsal. Length 6 inches. (Gill.) Pacific Coast of Mexico; common in rock pools about Cape San Lucas. (*occidentalis*, western.)

*Myriopristis occidentalis*, GILL, Proc. Ac. Nat. Sci. Phila., 1863, 87; Cape San Lucas. (Coll. Xantus.)

*Rhamphoberyx leucopus*, GILL, *l. c.*, 88, Cape San Lucas. (Coll. Xantus.)

### 1232. MYRIPRISTIS PŒCILOPUS (Gill).

Head 4 in extreme length; depth 3⅓; eye 2; snout 5, blunt. D. X–I, 11; scales 3–35 or 36–7. Olive green, golden green below, and cupreous on the opercle; spinous dorsal dark green in front of each spine, but light behind as well as above and below; black in spirits; spinous dorsal margined with dark; ventrals with a broad blackish terminal band; base of caudal punctulate with dark spots. (Gill.) Cape San Lucas. Known from the types, which are very young; probably the young of *Holocentrus suborbitalis*. (*ποικίλος*, variegated; *πούς*, foot.)

*Rhamphoberyx pœcilopus*, GILL, Proc. Ac. Nat. Sci. Phila., 1863, 87, Cape San Lucas. (Coll. Xantus.)

## 382. HOLOCENTRUS (Gronow) Scopoli.

### (SQUIRREL-FISHES.)

*Holocentrum*, ARTEDI, Seba, III, about 1740, nonbinomial, (*rubrum*).

*Holocentrus*, GRONOW, Zoophyl., 65, 1763, (*rostratus*, nonbinomial).

*Holocenthrus* (GRONOW), SCOPOLI, Int. Hist. Nat., p. 449, 1777.

*Holocentrus*, BLOCH, Ichthyol., IV, 61, 1790, (*sogo*).

*Rhynchichthys*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., VII, 503, 1831, (*pelamidis*) (young).

*Holocentrum*, of authors generally.

*Rhinoberyx*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 237, (*brachyrhynchus*); young; scales said to be 25; may represent a distinct genus.

Body oblong, moderately compressed, the ventral outline nearly straight, the back a little elevated, the tail very slender. Head compressed, narrowed forward. Operculum with a strong spine above, below which the edge is sharply serrated; a strong spine at the angle of preopercle. Orbital ring, preorbital, preopercle, interopercle, subopercle, occiput, and shoulder girdle with their edges sharply serrate. Mouth small, terminal, the lower jaw projecting in the adult; in the young (which constitute the supposed genera *Rhynchichthys* and *Rhinoberyx*) the snout is much produced. Maxillary broad, striate, with a supplemental bone. Eye excessively large. Scales moderate, closely imbricated, the posterior margin strongly spinous. Lateral line continuous. Dorsal deeply emarginate, the spines usually 11, depressible in a groove; soft dorsal short and high; anal with 4 spines, the first and second quite small, the third very long and strong, the fourth smaller; caudal widely forked; both lobes with the rudimentary rays spine-like; ventrals large, I, 7, the spine very strong. Species numerous, remarkable for the development of sharp spines almost everywhere on the surface of the body. (ὅλος, whole; κέντρον, spine; spinous all over.)

*a.* Preopercular[*] spine long, tapering, acute; third anal spine very long, more than half depth of body.
  *b.* Mouth moderate, lower jaw extending to below first ⅓ to ½ length of eye.
    *c.* Scales small, 50 to 55 in lateral line; upper lobe of caudal longer than lower, falcate; soft dorsal and anal elevated, pointed at tip, this character subject to variation. ASCENSIONIS, 1233.
    *cc.* Scales moderate, about 45; depth of body 2⅗ in length; membrane of front spines of dorsal black. SICCIFER, 1234.
    *ccc.* Scales rather large, 38 to 42 in lateral line; caudal lobes nearly or quite equal.
      *d.* Maxillary extending to below middle of eye.
        *e.* Depth of body greater than length of head.
          *f.* Third anal spine 1½ in head. SUBORBITALIS, 1235.
          *ff.* Third anal spine 1⅘ in head. CORUSCUS, 1236.
        *ee.* Depth of body equal to length of head. BRACHYPTERUS, 1237.
        *eee.* Depth of body less than length of head; dorsal without black; cheeks without white dots. MARIANUS, 1238.
      *dd.* Maxillary extending to below first third of eye; dorsal with black markings. VEXILLARIUS, 1239.
  *bb.* Mouth small, maxillary reaching to below first fourth of eye; upper lobe of caudal longer; cheek with a white blotch. OSCULUS, 1240.
*aa.* Preopercular spine short, flattish, notched at tip; third anal spine short, its length about ⅓ depth of body; soft dorsal and anal low, rounded. SANCTI-PAULI, 1241.

### 1233. HOLOCENTRUS ASCENSIONIS (Osbeck).

(MATEJUELO; SQUIRREL-FISH; SOLDADO; WELSHMAN.)

Head 3⅜; depth 3⅖; eye 2⅘; snout 4¼. D. XI, 15; A. III, 10; scales 5-50 to 54-7; cœca 25; vertebræ 11 + 16. Mouth small, little oblique, maxillary scarcely reaching middle of eye. Longest dorsal spines more than half length of head; soft dorsal pointed, as high as the body; third anal spine very strong, as long as longest anal rays, $1\frac{2}{3}$ in depth of body. Upper lobe of caudal much the longer. In life chiefly bright red, with shining longitudinal streaks along the rows of scales; some specimens somewhat darker, and tinged with olive above; fins light red, the spinous dorsal largely golden olive, its edge scarlet; head quite red above; an oblique white bar descends backward from the eye; these colors fading in spirits. This species varies much in the depth of body and the height of the fins. Length about 2 feet. West Indies, about rocks and reefs, ranging from Florida to St. Helena; very common in Cuba; a most brilliantly colored fish, often seen in tropical markets. (Name from Ascension Island.)

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[*] Little dependence can be placed on this analytical key, as several species are imperfectly known and of doubtful validity.

*Perca ascensionis*, Osbeck, Iter Chin., 388, 1771, Ascension Island.

*Bodianus pentacanthus*, Bloch, Ausl. Fische, IV, 40, pl. 225, 1790, Brazil; after *Jaguaraca* of Marcgrave.

*Holocentrus sogo*, Bloch, *l, c.*, 61, pl. 232, 1790, Africa.

*Sciæna rubra*, Bloch & Schneider, Systema Ichthyol., 82, 1801; after *Perca marina rubra* of Catesby.

*Amphiprion matejuelo*, Bloch & Schneider, Syst. Ichthyol., 206, 1801, Cuba; after *Matejuelo* of Parra.

*Bodianus jaguar*, Lacépède, Hist. Nat. Poiss., IV, 286, 1802, Brazil; after *Jaguaraca* of Marcgrave.

*Holocentrum longipinne*, Cuvier & Valenciennes, Hist. Nat. Poiss., III, 185, 1829, Martinique; San Domingo; Porto Rico; St. Thomas; Havana.

*Holocentrus longipinne*, Günther, Cat., I, 28, 1859.

*Holocentrus pentacanthus*, Jordan & Gilbert, Synopsis, 459, 1883.

? *Holocentrus striatus*, Gronow, Cat. Fishes, 173, 1854, Antilles; name preoccupied.

? *Holocentrus rostratus*, Gronow, *l. c.*, 173, 1854, near the Equator; young specimen; unidentifiable.

Represented in the West Indies by

### 1233a. HOLOCENTRUS ASCENSIONIS RUFUS (Walbaum).

Specimens of this species from Bahia, apparently representing the true *ascensionis*, differ from Cuban examples. The latter may be regarded as a distinct subspecies, for which the oldest name is that of *rufus* of Walbaum (=*ruber*=*rubra*=*jaguar*=*longipinnis*). The Brazilian form (var. *ascensionis*) has the preopercular spine not reaching past the gill opening, its free portion $2\frac{1}{3}$ in eye. Pectoral short, $1\frac{5}{6}$ in head, measured to end of opercular spine; ventrals reaching vent; third anal spine measured from the scales, $2\frac{1}{6}$ in head; soft dorsal $1\frac{1}{2}$ in head; caudal lobe not quite equal to head. In var. *rufus* the preopercular spine reaches about to root of pectoral, its free part $1\frac{1}{2}$ in eye. Third anal spine $1\frac{9}{10}$ in head; soft dorsal $\frac{1}{10}$ longer than head; caudal lobe about $\frac{1}{3}$ longer. The color and form of body seem to be the same in both subspecies. (*rufus*, red.)

*Perca rufa*, Walbaum, Artedi Pisc., 351, 1792, Bahamas; after *Perca marina rubra* of Catesby.

### 1234. HOLOCENTRUS SICCIFER, Cope.

Head with spines $2\frac{3}{4}$; depth $2\frac{1}{2}$. D. XI, 13; A. IV, 9; scales 3-45-8; eye $2\frac{3}{5}$ times in head and $\frac{3}{4}$ interorbital width. Spinous dorsal rather short, elevated; last spine very short, only connected with first soft ray within the groove. Second dorsal not elevated, first rays equal to 1¼ length of longest spines. Third anal ray not reaching basis of caudal; scales bordering anal fin, prolonged into grooved blades; body scales strongly pectinate, not grooved; muzzle contracted, especially laterally, the maxillary reaching anterior margin of pupil; anterior supernumerary maxillary minute; operculum finely denticulated; opercular spines 2, equal, elongate; a pair of smaller spines at summit of operculum; one spine directed backward at front of preorbital bone, all the lateral bones serrate; interorbital carinæ very weak; ventral fins not reaching vent. Color in spirits silvery; a brown longitudinal band between each two rows of scales, to middle of sides; below this brown punctæ in the same position; head brown shaded; fins white, except first dorsal, which is blackish; the membranes of first to third spines black, with white or pale spots at base and one at margin; chin brown. Length of type 2¾ inches. This species differs from *H. ascensionis*, of the same size, in the wider interorbital space, narrower muzzle, upper pair of opercular spines, free opercular serration, deeper body, color, etc. It differs in coloration from the species described by Poey, who also does not mention any of the peculiarities of this fish in any of them. Bahamas; one specimen known. (Cope.) (*siccus*, dry; *fero*, to bear.)

*Holocentrum sicciferum*, COPE, Trans. Amer. Philos. Soc., XXX, 1866, 465, **New Providence, Bahamas.**

### 1235. HOLOCENTRUS SUBORBITALIS, Gill.

(MOJARRA CARDENAL.)

Head 3; depth 2⅗; eye 2½; snout 4½. D. XI, 14; A. IV, 9; scales 4–38–7. Mouth moderate, scarcely oblique, maxillary about reaching middle of eye. Longest dorsal spines 1¾ in head; soft dorsal about as high as spinous portion, sheathed with scales at base; third anal spine 1½ in head; first anal rays about as long as third anal spine, the others graduated to the last, which is less than half length of first; pectorals about as long as third anal spine or 1½ in head; ventrals as long as pectorals. Steel colored, thickly sprinkled with dark dots, which become less numerous downward; the fins are dark, the dorsal lighter on the anterior half at the base between the spines; the suborbital chain is bright silvery and immaculate. Adult specimens recently obtained at Mazatlan are described as follows: Head 3; depth 2⅔. D. XI, 12; A. IV, 8; V. I, 7; scales 3–36–7, 7 on cheek. Dorsal spine 1¾; dorsal ray 1¾; caudal 1⅓; third anal ⅗. Pectoral 1⅖. Maxillary slipping under preorbital. Ventral with accessary scale; dorsal in a groove. Body short and deep, compressed with slender caudal peduncle, anterior profile rounded. Mouth small; upper jaw protractile. Teeth in uniform bands on jaws, vomer, and palatines. Maxillary moderate, slipping under very narrow preorbital, which, like rest of suborbital ring, is armed with close-set sharp teeth turned backward. Preopercle, opercle, subopercle, interopercle, postemporal, armed with similar teeth. Preopercle spine nearly as long as pupil; 2 spines in opercle. Steel gray, underlaid by bright. coppery red, which becomes brighter after death; everywhere much punctate with black, the dots coarse; sides and especially back with purple reflections. Top and side of head coppery, a curved bright silvery streak from tip of snout below eye and around it, ceasing opposite middle of pupil; a vertical silver streak on edge of opercle and extending out on spine; head yellowish, upper tip reddish and lower with throat silvery; dorsal brown, clouded with reddish and dark; dark brown near edge, then a series of grayish clouds, roundish irregular whitish spots at its base; second dorsal reddish, its ray pale, the first two black; the caudal red, base pale, the upper and lower rays dark yellowish, darkest in young, the dark extending on peduncle above and below; anal spines whitish, the soft rays birch red, the last ones pale, the first soft rays dark; ventral reddish, the spine and first soft ray whitish, the first ray dark red; when the fins are closed it seems reddish edged with whitish or yellowish and with a blackish line. The dark is fainter in larger specimens. Very common in rock pools about the Gulf of California, rarely exceeding 8 inches in length. Mazatlan to Panama; a small species abundant in rock pools. (*suborbitalis*, below the eye.)

*Holocentrum suborbitale*, GILL, Proc. Ac. Nat. Sci. Phila., 1863, 86, Cape San Lucas. (Coll. Xantus.)

### 1236. HOLOCENTRUS CORUSCUS, Poey.

Head $2\frac{4}{5}$ ($3\frac{1}{2}$); depth $2\frac{2}{3}$ ($3\frac{1}{3}$). D. XI, 14; A. IV, 9; scales 3–42–8. Eye very large, $2\frac{1}{3}$ in head; snout very short, 2 in eye. Body shaped as in *H. suborbitalis*, a Pacific Coast species, to which it is nearly related. Mouth small, maxillary reaching past anterior margin of pupil, 3 in head. Width of interorbital space not as long as maxillary, $3\frac{1}{3}$ in head; bones of top of head marked as in *Holocentrus suborbitalis*, except that a few of the upper occipital ridges are serrated. Spines on preopercle, opercle, interopercle, preorbital and suborbital, as in the western species; spines on subopercle a few more; scales on body as in *ascensionis* or *suborbitalis*; nuchal scale as large as in the latter; five rows of scales on cheek, none on opercle. Spinous dorsal moderately high; first spine 3 in head; third spine longest, $2\frac{1}{4}$ in head; soft dorsal higher than spines; not falcate, as in *ascensionis*; longest ray $1\frac{5}{7}$ in head; third anal spine longest, almost 2 in head; longest ray $1\frac{4}{5}$ in head, not falcate; pectorals $1\frac{3}{7}$ in head; ventrals $1\frac{4}{7}$; its outer rays not produced, about $\frac{2}{5}$ diameter of eye from vent; upper caudal lobe apparently not much produced, $1\frac{2}{5}$ in head. Color in spirits pale silvery, edges of scales showing bright steel-blue reflections; a reddish shade above lateral line; bands of dots following rows of scales, those below lateral line widest and most diffused; no markings on head with the exception of dots; spinous dorsal dusky; a large black spot between first and third spine; membrane between bands of posterior spines with dusky spots; a row of whitish angular spots on the anterior part of membrane between each two spines, those between the third and sixth spines longest, the two anterior well developed below the large black spot; other fins pale; upper angle of pectoral with a group of dots; black blotches between first and second and second and third spines.

West Indies, known from Cuba and the Bahamas; very close to *Holocentrus suborbitalis*. (*coruscus*, sparkling.)

*Holocentrum coruscum*, Poey, Memorias, II, 158, 1860, Cuba; Jordan & Bollman, Proc. U. S. Nat. Mus., 1888, 550.

### 1237. HOLOCENTRUS BRACHYPTERUS, Poey.

Head 3⅓ in total length with caudal; depth 3½; eye 3; snout 4. D. XI, 13; A. IV, 8; scales 40. Mouth moderate, maxillary reaching middle of eye. Soft dorsal and anal not pointed; caudal lobes equal. Carmine; longitudinal rosy streaks along rows of scales; a pale band along spinous dorsal; no white band on cheek. (Poey.) Cuba; a doubtful species, perhaps the same as *H. vexillarius*. (βραχύς, short; πτερόν, fin.)

*Holocentrus brachypterus*, Poey, Repertorio, 184, 1866, Cuba.

### 1238. HOLOCENTRUS MARIANUS, Cuvier & Valenciennes.

(Marian.)

Head 3 in total length with caudal; depth 3⅔. D. XI, 13; A. IV, 8. Body rather deep; snout long, mouth large, maxillary reaching middle of eye; opercular spines 2, short and subequal. Soft dorsal reaching ⅔ length of caudal peduncle; third anal spine very strong, its length ¾ depth of body, longer than first soft ray. Caudal lobes equal. Pyloric cœca 8 to 10. Bright red, the spinous dorsal with two rows of white spots; other fins carmine; no white blotch on cheeks. (Poey.) (*Marian*, a negro word meaning tough and lean—a fish of much bone and little flesh.)

*Holocentrum marianum*,* Cuvier & Valenciennes, Hist. Nat. Poiss., III, 219, 1829, Martinique.
*Holocentrum rostratum*, Poey, Memorias, II, 157, 1860, Cuba; name preoccupied.

### 1239. HOLOCENTRUS VEXILLARIUS, Poey.

Head 3⅘ in total length with caudal; depth 3⅔; eye 2¾. D. XI, 13; A. IV, 8; snout short; maxillary reaching first third of eye. Caudal lobes equal, vertical fins not very high; third anal spine ⅗ depth of body. Metallic white, flushed with red-brown streaks along the edges of scales; dorsal whitish, with large dark-red spots; spinous dorsal with a black vertical bar behind each ray, not reaching its base; soft dorsal, anal, and caudal with dark-red border. (Poey.) Cuba; not seen by us. (*vexillarius*, pertaining to a banner; from the marks on the dorsal fin.)

*Holocentrum vexillarium*, Poey, Memorias, II, 158, 1860, Cuba.
*Holocentrum productum*,† Poey, Synopsis, 300, 1868; described from specimen 3 inches long; young, as shown by the protruding snout.
? *Holocentrum riparium*,‡ Poey, Enumeratio, 37, 1875, Cuba.

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* *Holocentrus marianus*, Cuvier & Valenciennes:
D. XI, 12; A. IV, 9. Third anal spine exceedingly long. Color silvery red, without longitudinal streaks. No black spot on the dorsal, nor dark points on the scales. Lower jaw projecting. Opercle with two flat points. Martinique.—*Cuvier & Valenciennes.*

† Head 3¾ in total; depth the same; eye 3, half longer than snout. D. XI-15; A. IV, 10; snout projecting; maxillary reaching front of pupil. Upper spine of opercle with a black point or perforation at base. Dorsal low, its highest spine half depth of body; third anal spine strong. Rosy; belly silvery; series of scales scarcely marked by streaks; fins red; first two and last two interspaces between spines dusky. Matanzas.—*Poey.*

‡ *Holocentrum riparium* is based on small specimens found in shallow water along the reefs and is said to differ from *vexillarius* in having the first three spines only with black interspaces. It is possibly a distinct species, but needs verification.

### 1240. HOLOCENTRUS OSCULUS, Poey.

D. XI, 15; A. IV, 10. Mouth small, the maxillary reaching first fourth of eye. Scales deeply furrowed. Upper lobe of caudal longer. Red; a diffuse white blotch on side of belly and one on cheek. First three anal spines whitish. Cuba. (Poey); not seen by us. (*osculus*, small-mouthed.)

*Holocentrum osculum*, POEY, Memorias, II, 156, 1860, Cuba.
*Holocentrum perlatum*, POEY, *l. c.*, 157, Cuba; female specimen with a white blotch behind tip of each dorsal spine; wanting in type of *osculum*, which was a male.

### 1241. HOLOCENTRUS SANCTI-PAULI, Günther.

Head 3; depth 2½; eye 4; snout 4; interorbital width 5 in head, including opercular flap. D. XI, 15; A. IV, 10; scales 48–3½. Maxillary not reaching to vertical from center of eye. Operculum with a strong and thick triangular spine, and with denticulations beneath; preopercular spine broad, flattened, and cleft, or bifurcate at its extremity; its length 3½ times in that of posterior edge of preoperculum; third and fourth dorsal spines longest, a little less than half length of head; soft dorsal rather elevated, more than half height of body; caudal deeply forked, upper lobe much longer than lower; third anal spine very strong, 3 in height of body. Ventral fins about ¾ length of head, terminating at a great distance from the anus; pectoral shorter than the ventrals. Uniform red. Length 16 inches. St. Paul Rocks, mid-Atlantic.

*Holocentrum sancti-pauli*, GÜNTHER, Shore Fishes, 4, 1880, St. Paul Rocks.

## 383. PLECTRYPOPS, Gill.

*Plectrypops*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 237, (*retrospinis*).

This genus differs from *Holocentrus* chiefly in having the preopercle armed with three strong teeth curved forward. The preopercular spine is moderate, and the third anal spine not greatly developed. One species. (*πλῆκτρον*, spur; *ὑπό*, below; *ὤψ*, eye.)

### 1242. PLECTRYPOPS RETROSPINIS (Guichenot).

Head 2¾ in total length; depth 2½. D. XII, 14; A. III (?) or IV, 11. The infraorbital arch is armed beneath with three long spines, curved and directed forward; the spines of the preorbital and of the posterior part of the infraorbital arch with smaller spinous teeth. Both limbs of the preoperculum denticulated, with a rather strong flat spine; operculum and suboperculum armed with spinous teeth, the former with two long spines, the lower of which is the stronger. Spines of the fins rather slender; the soft portions of the dorsal and anal fins rounded, and as high as the spinous. Caudal forked; scales deeply serrated. Uniform red. Cuba. (Guichenot); rare. (*retro*, backward; *spina*, spine; but the spines are directed forward.)

*Holocentrum retrospinis*, GUICHENOT, in Ramon de la Sagra, Hist. Cuba, 35, pl. 1, fig. 3, 1850, Cuba.
*Holocentrum prospinosum*, POEY, Memorias, II, 343, 1861; after GUICHENOT. Substitute for *retrospinis*, as the spines turn forward and not backward; GÜNTHER, Cat., I, 49, 1859.

## Family CXVI. POLYMIXIIDÆ.

### (THE BARBUDÓS.)

Body rather elongated and compressed; scales not serrated; lateral line continuous with back; head compressed, and with a decurved profile; preoperculum serrated; mouth with a lateral and nearly horizontal cleft; teeth villiform, on both jaws and on palate; branchiostegal apertures large, the gill membranes separate, free from the isthmus; branchiostegals 4; dorsal moderately elongated, with several spines, increasing backward; anal opposite the posterior portion of dorsal, armed with 3 or 4 spines; pectorals with branched rays; ventral fins thoracic, each with a spine and 6 or 7 rays. Vertebræ in increased number (29). The family is distinguished by the combination of chin barbels, increased number of rays, and small number of branchiostegals. Its affinities are doubtful, but on the whole seem to be rather with the *Mullidæ.* (Gill.) The increased number of ventral rays and the structure of the fins seem to point to Berycoid rather than Percoid affinities. For this reason we leave the *Polymixiidæ* near the *Berycidæ,* and place the *Mullidæ* next to it.

A single genus, with 1 to 3 species, inhabiting rather deep waters in the tropical Atlantic and Pacific. (*Berycidæ,* genus *Polymixia,* Günther, Cat., I, 17, 1859.)

### 384. POLYMIXIA, Lowe.

### (BARBUDO.)

*Polymixia,* LOWE, Trans. Cambr. Phil. Soc., 1838, 198, (*nobilis*).
*Nemobrama,* VALENCIENNES, Berher-Webb & Berthelot, Ich. Iles Canar., 40, 1844, (*webbii*).
*Dinemus,* POEY, Memorias, II, 160, 1860, (*venustus*).

Characters of the genus included above. (πολύς, many; μίξις, mixing; a mixture of the characters of many groups.)

### 1243. POLYMIXIA LOWEI, Günther.

Head 3¾; depth 3¾; eye 3–. D. V, 30; A. III, 16; scales 50. Anterior profile slightly convex, but descending rapidly from eye to snout; posterior profile gradually descending to the caudal fin; lower profile nearly straight between snout and anal fin. Snout short, obtuse, lower jaw overlapped by the upper. Interorbital width 4 in head, covered with scales to near the anterior margin of the eyes. Cleft of mouth wide, maxillary reaching to behind eye, ending in a broad plate with a convex posterior edge and a concave superior and inferior one. Lower jaw with a slight prominence in front. Eye placed high; suborbital less than diameter of eye. Opercles without spines; these and the subopercles densely scaled. Origin of dorsal midway between snout and base of caudal, the fifth spine about half as long as the first ray, which is the longest; the following rays become shorter and shorter to the seventeenth, the remaining ones being short and nearly equal in length. Caudal fin deeply forked, with pointed and equal lobes; anal fin similar to the dorsal in shape, but shorter and lower; the third spine about ⅓ of the first ray, which equals the fifth dorsal ray. Pectorals short and pointed, reaching beyond origin of dorsal; ventrals very short. Teeth in broad, velvet-like bands. (Günther.) Uniform greenish above, sides golden shining. Caribbean Sea, in deep water; occasionally taken in Cuba. (Named for Rev. Richard Thomas Lowe, British chaplain in Madeira, an accomplished and careful ichthyologist, author of the Fishes of Madeira.)

*Polymixia lowei,** GÜNTHER, Cat., I, 17, 1859, Caribbean Sea.
*Dinemus venustus*, POEY, Memorias, II, 160, 1860, Cuba.

## Family CXVII. MULLIDÆ.

### (THE SURMULLETS.)

Body elongate, slightly compressed, covered with large scales which are usually slightly ctenoid; lateral line continuous, the pores often branched; large scales on the head; upper profile of the head more or less parabolic. Mouth small, low, subterminal; teeth mostly small, variously placed; no canines, incisors, nor molars. Premaxillaries somewhat protractile; maxillaries thin, nearly as broad at base as at tip, without supplemental bone, partly hidden by the broad preorbital. Preopercle entire or slightly serrate; opercle unarmed, or with a single spine. Eye moderate, placed high; branchiostegals 4; pseudobranchiæ present; 2 long unbranched barbels at the throat, attached just behind the symphysis of the lower jaw. Dorsal fins 2, remote from each other, both short, the first of 6 to 8 rather high spines, which are depressible in a groove; anal short, similar to the soft dorsal, with 1 or 2 small spines; ventrals thoracic, I, 5. Air bladder usually present, simple. Vertebræ $9+14=23$; stomach siphonal; pyloric cœca about 20. Species about 40, referable to 5 closely related genera, found in all tropical seas, some species straying northward. Many of the species are highly valued as food, especially the European *Mullus barbatus* and *Mullus surmuletus*. The family is a very natural one and not closely related to any other. It bears some superficial likeness to the *Sciænidæ* and the *Cheilodipteridæ*, but this may not show real affinity. The singular barbels appear also in the *Polymixiidæ*, but in that family the ventral rays are numerous, as in *Berycidæ*. The small number (4) of the branchiostegals is found both in *Mullidæ* and *Polymixiidæ*. As the singular hyoid barbels are not likely to have been developed independently in two unrelated groups, we place the *Mullidæ* and *Polymixiidæ* together. As the latter group seems to have Berycoid affinities, we leave the *Mullidæ* with the *Berycoidei*, although they show no resemblance to the Berycoids, other than the characters shared with the *Polymixiidæ*. (*Mullidæ*, Günther, Cat., I, 397–411, 1859.)

*a*. Teeth on lower jaw, vomer, and palatines; upper jaw toothless; the bone which forms a downward hook over maxillary strongly developed; interorbital space flat and wide; opercle without spine. MULLUS, 385.

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*This species has been recently identified by Günther with the rare but almost cosmopolitan *Polymixia nobilis*, Lowe. The latter has D. V, 37 or 38, a difference beyond the ordinary range of variation. We therefore retain the American species, *Polymixia lowei*, as provisionally distinct, although Dr. Günther claims to have a complete series of connecting forms.

*aa.* Teeth on both jaws; vomer and palatines toothless; the bone which forms a downward hook over the maxillary moderately developed; interorbital space rather narrow; opercle ending in a single spine.

*b.* Teeth small, subequal, in villiform bands in both jaws. MULLOIDES, 386.

*bb.* Teeth rather strong, unequal, in one or two series in each jaw. UPENEUS, 387.

## 385. MULLUS, Linnæus.

(SURMULLETS.)

*Mullus*, LINNÆUS, Systema Naturæ, Ed. x, 1758, 299, (*barbatus*).

Villiform teeth in the lower jaw and on the vomer and palatines; none in the upper jaw; the bone forming a hook over the maxillary well developed; opercle without spines; interorbital space flat and wide. Otherwise as in *Upeneus*, the head rather shorter. One species known. (Latin, *Mullus*, *μύλλος*, the ancient name of *Mullus barbatus*, from *μύλλος*, lip; hence "mullet," a fish with thick lips.)

### 1244. MULLUS AURATUS, Jordan & Gilbert.

Head 3⅖; depth 3¾ to 4; eye 3⅜; oblique length of snout 2⅗. D. VII–I, 8; A. II, 6; scales about 40. Form essentially as in the European *Mullus barbatus*, the profile a little less steep, the interorbital space a trifle broader, the maxillary extending exactly to opposite front of eye, its length 2¾ in head. Interorbital width 3½ in head; barbels 1¼. Teeth in lower jaw small; on upper jaw obsolete; on vomer and palatines coarse and granular, forming large patches. Gill rakers slender, a little shorter than pupil. Dorsal spines slender, compressed, the longest about 1⅗ in head (1½ to 1⅓ in *Mullus barbatus*); height of soft dorsal half head; caudal as long as head. Pectoral 1⅖ in head; ventrals 1⅓. Scales mostly lost, so that the number in the lateral line can not be counted. Color scarlet, becoming crimson where the scales are removed; snout scarlet; side with two distinct longitudinal yellow stripes. Caudal scarlet, first dorsal with an orange band at base and a yellow band higher up; the rest of the fin pale; no black on dorsal fin. Second dorsal mottled scarlet and pale; anal and ventrals plain, pectoral reddish; iris violet, dusky above; sides of head with silvery luster. Length 8 inches. Eastern coast of North America; Cape Cod to Pensacola, occasionally taken in some numbers at Woods Hole, Massachusetts, and found among the spewings of snappers and groupers off the Florida Snapper Banks. Very close to the European *Mullus barbatus*, and especially to *surmuletus*, differing in the rather lower fins, the black band on the dorsal replaced by yellow. (*auratus*, gilded.)

*Mullus barbatus auratus*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 280, Pensacola; (Type, No. 30828. Coll. Jordan); JORDAN & GILBERT, Synopsis, 931, 1883.

*Mullus auratus*, JORDAN, Proc. U. S. Nat. Mus., 1884, 39; HALL & MCCAUGHAN, Proc. Ac. Nat. Sci. Phila., 1885, 151.

## 386. MULLOIDES, Bleeker.

*Mulloides*, Bleeker, Ceram., II, 697, 1865, (*flavolineatus*).

This genus differs from *Upeneus* only in the dentition, the teeth in both jaws being in narrow villiform bands, none on vomer or palatines. Species numerous, chiefly of the Pacific Ocean. (*Mullus*; εἶδος, resemblance.)

### 1245. MULLOIDES RATHBUNI (Evermann & Jenkins).

Head 3½; depth 4; eye large, 2⅔ in head, or 1½ in snout. D. VIII–I, 8; A. I, 6; scales 2½–41–6. Body slender. Dorsal outline well arched; profile from snout to origin of first dorsal regularly curved, except above the eyes, where it is very slightly flattened; from first dorsal to posterior end of second dorsal gently convex, and from there to the caudal slightly concave; ventral outline nearly straight to caudal fin; head triangular; snout blunt-pointed; least depth of caudal peduncle 2¾ in head, and its length 1¼ in the same; mouth slightly oblique; the maxillary, which is 3¼ in head, greatly broadened behind, almost reaching anterior margin of orbit; preorbital deep and broad, its depth 3½ in head; lower jaw slightly included; barbels moderate, scarcely reaching posterior edge of opercles; preopercle very weakly serrate. First dorsal spine minute, the second, third, and fourth subequal, 1½ in head, the others decreasing gradually, the eighth being contained less than 3 times in head; longest soft dorsal ray 2⅕ in head; anal spine evident; longest anal rays 2⅔ in head; pectorals 1½ in head, reaching posterior edge of spinous dorsal; ventrals equaling pectorals. Scales large, ctenoid; head well scaled, 3 scales upon the maxillary bone, a row of 6 upon cheek, and an odd one on its lower margin; preopercle and opercle with about 2 rows each; preorbital without scales, but roughened by a very evident set of irregularly radiating lines; the branches of the pores in scales of lateral line large and numerous, as many as 13 being counted in some scales. Teeth villiform, in a band broadest in front and narrowing backward. Gill rakers slender, the longest 3½ in maxillary, about 16 below angle. Peritoneum black. Length about 8 inches. Known only from Guaymas, Gulf of California. (Named for Mr. Richard Rathbun, Chief of the Division of Inquiry respecting Food Fishes, United States Fish Commission.)

*Upeneus rathbuni*, Evermann & Jenkins, Proc. U. S. Nat. Mus., 1891, 158, pl. 2, fig. 4, Bay of Guaymas. (Type, No. 43241. Coll. Evermann & Jenkins.)

## 387. UPENEUS, Cuvier.

### (Goatfishes.)

*Upeneus*,* Cuvier, Règne Animal, Ed. 2, Vol. 2, 157, 1829, (*vittatus*; *russellii*; *bifasciatus*; *trifasciatus*); (restricted by Bleeker to *bifasciatus*).

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* The name *Upeneus* was first restricted by Bleeker to the species which, like *bifasciatus*, have the teeth in both jaws conic and uniserial; those with teeth on jaws, vomer, and palatines also being called *Upeneoides*. But as *Upeneoides vittatus* is the first species mentioned under *Upeneus* by Cuvier, Bleeker afterwards transferred the name *Upeneus* to this group, giving the new name *Parupeneus* to *Upeneus bifasciatus*. In our judgment the first restriction should hold, and the name *Upeneus* should go with *Upeneus bifasciatus*.

*Hypeneus*, AGASSIZ, Nom. Zoöl., Index Universalis, 190, 1846, (amended orthography).

*Pseudupeneus*, BLEEKER, Poiss. Côte de Guinée, 56, 1862, (*prayensis*); (teeth biserial above, uniserial below).

*Parupeneus*, BLEEKER, Notice sur le *Parupeneus bifasciatus*, de l'Ile de la Réunion, 345, 1867, (*bifasciatus*); (teeth uniserial, conic, in both jaws).

*Mullhypeneus*, POEY, Synopsis, 307, 1868, (*maculatus*); teeth partly biserial above, uniserial below.

*Brachymullus*, BLEEKER, Archiv. Neerl., XI, 333, 1875, (*tetraspilus*).

Body oblong, compressed; mouth moderate, nearly horizontal, low, the jaws subequal; eye large, high, posterior; opercle short, deep, with a posterior spine; both jaws with rather strong unequal teeth, in one or two series in each jaw; no teeth on vomer or palatines; lips well developed; the bone which forms a hook over the maxillary less developed than in *Mullus*; interorbital space concave and narrow; opercle ending in one spine; barbels nearly as long as head; scales very large, somewhat ctenoid; lateral line continuous, its tubes ramifying on each scale; head covered with large scales; first dorsal with about 7 spines; anal with 2, the first very short; caudal fin forked. Species numerous in the tropical seas. (An old name of some fish; from ὑπήνη, upper lip.)

*a.* Teeth in both jaws uniserial (or irregularly biserial above); all the teeth coarse and distinct.
  *b.* Eye 4 in head; barbels 1⅓ in head. Scales 31; depth 4 in length; sides with 3 black blotches. MACULATUS, 1246.
*aa.* Teeth of upper jaw uniserial, of lower biserial; teeth rather strong.
  *c.* Eye moderate, 3⅘ in head; scales 37; depth 4; a broad red band from eye to caudal. DENTATUS, 1247.
*aaa.* Teeth of both jaws biserial, at least in front.
  *d.* Scales moderate, about 40. Teeth all obtusely conic, distinct from each other; teeth on upper jaw turned inward; color red, with a bright yellow lateral streak.
    *e.* Dorsals and caudal with dark cross bands. PARVUS, 1248.
    *ee.* Dorsals and caudal plain yellow.
      *f.* Eye 3¼ in head in adult, 1⅕ in snout; head 3⅓ in length. MARTINICUS, 1249.
      *ff.* Eye 3⅝ in head in adult, 1⅔ in snout; head 3⅔ in length. XANTHOGRAMMUS, 1250.
  *dd.* Scales large, about 32; outer series of teeth of upper jaw formed by very obtuse teeth which are partly confluent; eye 4 in head; a pearly spot on each scale; each side of body with 2 black blotches; dorsal spotted. GRANDISQUAMIS, 1251.

### 1246. UPENEUS MACULATUS (Bloch).

(RED GOATFISH; SALMONETE.)

Head 3¼; depth 4; eye 4. D. VII or VIII–I, 8; A. II, 6; scales 30 or 31, the lateral line high up, following curve of back. Body oblong, moderately compressed, tapering backward from occiput; ventral outline nearly straight. Snout long and rather sharp; mouth terminal, small, maxillary not reaching orbit, 2¾ in head; eye situated backward and high up. Teeth on under jaw uniserial, on upper jaw uniserial or occasionally irregularly biserial, with the outer teeth turned outward; all the teeth coarse and distinct. Barbels extending to vertical of preopercle and extremity of opercular spine. Color red, the color deepening after death or with the removal of the scales; sides of head with bluish longitudinal lines; 3 black blotches along lateral line; each scale with a blue spot at base. In spirits, steel blue above, descending on the sides in 3 blotches—1 above point of opercular spine (sometimes extending on opercle), 1 under each dorsal fin; under parts of body pale. West Indies and Brazil, Key West to Rio Janeiro; generally common. A food-fish of some value, prettily colored. (*maculatus*, spotted.)

*Mullus maculatus*, Bloch, Ichthyologia, 348, 1793, Brazil.
*Urpeneus maculatus*, Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 478, 1829; Poey, Memorias, i, 223, 1851; Günther, Cat., i, 408, 1859; Jordan & Gilbert, Synopsis, 565, 1883.
*Mullhypeneus maculatus*, Poey, Synopsis, 307, 1868.
*Upeneus punctatus*, Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 482, 1829, Martinique.

### 1247. UPENEUS DENTATUS, Gill.

Head 3⅗; depth 4; eye moderate, 3⅘ in head in adult; snout 2½. D. VII–I, 8; A. II, 6; scales 2–37–5. Teeth of upper jaw uniserial, of lower biserial; teeth rather small, weaker than in *Upeneus grandisquamis*; barbels extending nearly to vertical of preopercle. Scales very deciduous; second dorsal spine 1⅔ in head. Color dusky above, sides bright rosy, with broad red band extending from eye to caudal and suffusing caudal. Length 1 foot. Pacific Coast of Mexico; rare. Known from Cape San Lucas, La Paz, and Tres Marias Islands. (*dentatus*, toothed.)

*Upeneus dentatus*, Gill, Proc. Ac. Nat. Sci. Phila., 256, 1862, Cape San Lucas; young. (Type, No. 3699. Coll. Xantus.) Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 263; Hall & McCaughan, *l. c.*, 154, 1885; Evermann & Jenkins, Proc. U. S. Nat. Mus., 1891, 157.

### 1248. UPENEUS PARVUS, Poey.

D. VII–I, 8; A. II, 6; scales 2½–40–6. Snout short and decurved; maxillary reaching front of eye; barbels reaching angle of preopercle, on jaws only. Teeth conical, very small, on anterior part of jaws in two series; lateral teeth in a single series; all the teeth obtusely conic and distinct from each other. Vermilion above, fading into white below; a yellow longitudinal band along the side, with similar narrower streaks below; ventrals and anal yellow; other fins whitish, with dusky cross bands, 3 on first dorsal, 2 on second, and 5 on each caudal lobe. (Poey.) Cuba. Known only from Poey's description. (*parvus*, small.)

*Upeneus parvus*, Poey, Memorias, i, 226, 1851, Cuba.

### 1249. UPENEUS MARTINICUS, Cuvier & Valenciennes.

(Yellow Goatfish; Salmonete Amarilla.)

Head 3½; depth 4: eye 3⅓ to 3½, large. D. VIII–I, 8; A. II, 6; scales 2½–37 to 39–7. Body moderately elongate; anterior profile gibbous before the eyes. Interorbital space flat, 3⅖ in head. Teeth on anterior part of jaws in two irregular series; lateral teeth in a single series; all the teeth obtusely conic, and distinct from each other; teeth on upper jaw turned inward; no teeth on vomer. Barbels reaching to vertical of preopercle, 1½ in head. Longest dorsal spine 1⅓ in head; anal small. Color pale red, deepening after death; sides with a broad longitudinal band of bright yellow; snout with yellow streaks; vertical fins and patches on sides of head bright yellow. Length 1 foot. West Indies, north to Key West; generally common; a handsome fish, valued as food.

*Upeneus martinicus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., III, 483, 1829, Martinique; young; HALL & MCCAUGHAN, *l. c.*, 154, 1885.

*Upeneus balteatus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., III, 484, 1829, Cuba; young.

*Upeneus flavovittatus*, POEY, Memorias, I, 224, 1851, Cuba; adult.

*Mulloides flavovittatus*, GÜNTHER, Cat., I, 403, 1859.

### 1250. UPENEUS XANTHOGRAMMUS, Gilbert.

Head 3⅔; depth 4 to 4¼; eye 1⅔ in snout, 3⅚ in head, in specimens 10½ inches long, (1⅕ in snout, 3¼ in head, in *martinicus* of the same size.) D. VII–I, 8; A. II, 6. Pores in lateral line 38, not counting two on base of caudal. Two and one-half rows of scales between lateral line and base of spinous dorsal. Fifteen developed gill rakers on horizontal limb of outer arch, with 5 smaller rudiments. Spinous dorsal not high, less than depth of body, 1½ to 1⅔ in head. Pectorals pointed, scarcely reaching tips of ventrals, 1½ in head. Ventrals reaching halfway to front of anal. Caudal very deeply forked, the lobes sharp, the upper the longer, equaling the length of head. Barbels reaching vertical from preopercle. Teeth in a narrow band anteriorly in each jaw, and in a single series laterally. Maxillary very wide posteriorly, projecting well beyond the border of the preorbital, its width ⅔ orbit. Red, with a broad yellow streak along sides. La Paz, Lower California. Very close to *Upeneus martinicus*, the head smaller, the eye much smaller. (*ξανθός*, yellow; *γραμμή*, line.)

*Upeneus xanthogrammus*, GILBERT, Proc. U. S. Nat. Mus., 1891, 553, La Paz. (Coll. Albatross.)

### 1251. UPENEUS GRANDISQUAMIS, Gill.

(CHIVO.)

Head 3 to 3⅓; depth 3 to 3⅗; eye 4; snout about 2½. D. VIII–I, 8; A. I, 6; scales 2–30 to 32–5. Teeth on anterior part of jaws in 2 series, those of the outer series of the upper jaw very obtuse and partly confluent. Barbels reaching to vertical from root of pectoral fins. Color light greenish brown above, rose-colored below lateral line; scales with indistinct pearly spot at center; black blotch on lateral line behind spinous dorsal; a smaller, somewhat indistinct black spot behind orbit; dorsal fins spotted with color of back; other fins immaculate. Pacific Coast of Mexico and Central America; Guaymas to Panama; generally common. (*grandis*, large; *squama*, scale.)

*Upeneus grandisquamis*, GILL, Proc. Ac. Nat. Sci. Phila., 1863, 168, west coast of Central America; STEINDACHNER, Ichth. Beiträge, IV, 6, 1875; HALL & MCCAUGHAN, *l. c.*, 155, 1885; EVERMANN & JENKINS, Proc. U. S. Nat. Mus., 1891, 156.

*Upeneus tetraspilus*, GÜNTHER, Proc. Zoöl. Soc. London, 1864, 148, Panama; GÜNTHER, Fishes Cent. Amer., 420, pl. 66, fig. 1, 1864.

## Group SCOMBROIDEI.

## (THE MACKEREL-LIKE FISHES.)

Body variously formed, usually adapted for rapid swimming; the scales usually small and cycloid or wanting, sometimes transformed into rough or bony plates, but rarely ctenoid. Lateral line various, usually undulate or with an anterior arch and a posterior straight part, at least not regularly arched; sometimes wanting. Flesh in typical forms firm, oily, and reddish in color, but in some cases pale and soft. Caudal peduncle almost always slender and strong, the caudal fin if present more or less deeply forked, except in certain deep-sea forms and in aberrant families, the structure typically adapted for swift propulsion. Dorsal fin usually long, the spinous portion generally shorter than the soft part, sometimes absent; the spines seldom very strong, sometimes not differentiated from the soft rays; anal fin always long, more of less similar to soft dorsal. Ventrals thoracic, subjugular, or subabdominal, usually with 1 slender spine and 5 rays, sometimes many-rayed, sometimes rudimentary or wholly wanting. Branchiostegals few, usually 7. Gills 4, a slit behind the fourth; gill rakers various; gill membranes usually separate, sometimes joined together, rarely attached to the isthmus. Mouth and dentition various. Skeleton firm or variously soft, the structure as in spinous-rayed fishes generally; the shoulder girdle attached to the cranium by a distinctly forked post-temporal, which is not adnate to the cranium. Vertebræ varying from 24 to more than 100, the high numbers found in pelagic species. Intestinal canal generally short. This group of mackerel-like fishes is not capable of exact definition, its deviations from the ordinary type of spiny-rayed fishes being various and in various directions, so that no set of diagnostic characters will cover them. The group is not a suborder as the term is generally understood; it is incapable of simple definition, and in its divergence some members approach to other groups more nearly than to extreme or even to typical members of their own. The group is, however, a somewhat natural one, as by the common consent of ichthyologists its different types have always been kept near each other in the system of classification. This naturalness, however, has been obscured by the intrusion of aberrant forms, as *Zeus*, *Oreosoma*, *Capros*, *Antigonia*, *Pempheris*, and *Lampris*. These forms have no near relationship to *Scomber*, *Caranx*, or *Coryphæna*, the central groups of the *Scombroidei*, and it may be that none of them are Scombroid fishes at all. Perhaps the earliest type of existing Scombroids is that of the genus *Lampris*; of the others, the *Scombridæ* proper form a center of divergence. The *Zeidæ* and *Caproidæ* are certainly not Scombroid fishes, nor are they at all closely related to each other. While it is uncertain just where they should go in a natural arrangement, we have thought best to remove them from the *Sombroidei*, with which they have usually been associated by recent writers, and reserve them for insertion elsewhere. From Scomber-like forms are descended on the one hand the *Gempylidæ*, *Lepidopidæ*, and *Trichiuridæ*. Another line of descent leads to *Acanthocybiinæ*, *Istiophoridæ*, and *Xiphiidæ*; still another apparently runs through *Carangidæ* to *Nomeidæ* and perhaps to *Coryphænidæ* and *Bramidæ*. Other forms, as *Tetragonuridæ*, are apparently not Scombroid, but their line of descent is not apparent and at present, knowing no better place for them, we leave them associated with the *Scombroidei*. (σκόμβρος, mackerel; εἶδος, likeness.)

## Families of SCOMBROIDEI.

- *a.* Ventral fins each composed of about 15 soft rays, attached to a very long pubic bone; coracoid bones very large and heavy; body very deep, compressed, unarmed, covered with minute scales. LAMPRIDIDÆ, CXXX.
- *aa.* Ventral fins with less than 8 soft rays, usually I, 5, sometimes wanting.
  - *b.* Bones of snout and upper jaw united and prolonged into a distinct sword; vertebræ about 24; scales minute or rudimentary.
    - *c.* Ventrals of 1 to 3 rays each; teeth present; scales present. ISTIOPHORIDÆ, CXXII.
    - *cc.* Ventrals and teeth wanting in the adult; scales obsolete. XIPHIIDÆ, CXXIII.
  - *bb.* Bones of snout not prolonged in a sword.
    - *d.* Body fusiform or band-shaped, with many vertebræ (30 to 120), small or minute scales and distinctly forked caudal on a slender peduncle (the fin sometimes wanting); lower jaw well developed, usually with a slit in the flesh to permit its motion; dorsal and anal long, the spinous part of dorsal well developed; the last rays of both fins often developed as finlets.
      - *e.* Caudal fin present.
        - *f.* Soft dorsal and anal distinct from spinous part, the anterior rays forming a more or less distinct lobe.
          - *g.* Body moderately elongate, fusiform; caudal peduncle with a distinct keel; finlets always present; ventrals I, 5; third and fourth pharyngeals united. SCOMBRIDÆ, CXVIII.
          - *gg.* Body decidedly elongate; caudal peduncle without keel; finlets present or absent; ventrals I, 5, or variously reduced; dentition strong. GEMPYLIDÆ, CXIX.
        - *ff.* Soft dorsal and anal more or less continuous with spinous dorsal, their anterior rays not forming a distinct lobe; ventrals rudimentary. LEPIDOPIDÆ, CXX.
      - *ee.* Caudal wanting, the body tapering to a point; ventrals rudimentary or wanting; dorsal and anal very long and low, continuous; dentition very strong. TRICHIURIDÆ, CXXI.
    - *dd.* Body and fins various, not showing the combination above noted under *d.*
      - *h.* Scales, if present, cycloid or ctenoid or lobate, not bony nor parchment-like; sometimes, especially in the young, with a median ridge on each one.
        - *i.* Caudal fin lunate or forked (or if rounded, the dorsal with very weak spines).
          - *j.* Anal fin not longer than dorsal and more or less similar to it in size and form.
            - *k.* Vertebræ 10 + 12 to 15 = 22 to 25.
              - *l.* First dorsal with its rays connected by membrane, sometimes becoming obsolete with age.
                - *m.* Anal preceded by 2 free spines (these often obsolete with age, connected by membranes to the fin in the young); no teeth in the œsophagus.
                  - *n.* Scales minute or obsolete, cycloid, those along lateral line sometimes armed; tail widely forked; third and fourth pharyngeals separate.
                    - *o.* No free anal spines; dorsal spines long and filamentous; pectorals very long and falcate; caudal well forked. NEMATISTIIDÆ, CXXIV.
                    - *oo.* Dorsal spines not long and filamentous; anal with two free spines, in young. CARANGIDÆ, CXXV.
                  - *nn.* Scales moderate, weakly ciliate; tail not deeply forked; canine teeth present. POMATOMIDÆ, CXXVI.
                - *mm.* Anal without free spines; scales moderate; œsophagus with tooth-like processes; dorsal fin very long; caudal little forked. CENTROLOPHIDÆ, CXXXIV.

*ll.* Spinous dorsal represented by several free spines; body elongate, fusiform; scales small; caudal little forked. RACHYCENTRIDÆ, CXXVII.

*kk.* Vertebræ 30 or more (in excess of 10 + 14).

*p.* Œsophagus with tooth-like processes; spinous dorsal and ventrals rudimentary or wanting; body compressed; caudal deeply forked; gill membranes attached to the isthmus or not. STROMATEIDÆ, CXXXV.

*pp.* Œsophagus without tooth-like processes; gill membranes free from the isthmus; caudal fin deeply forked; skeleton more or less firm.

*q.* Dorsal rays all with simple rays, none of them articulate or branched; ventrals jugular, I, 3 to I, 5. PTERACLIDÆ, CXXXI.

*qq.* Dorsal rays not all simple, some or all of them branched or articulate; ventral fins thoracic, I, 5.

*r.* Dorsal fin with a distinct spinous part.

*s.* Spinous dorsal well developed, the spines 10 to 12 in number.

*t.* Scales weak, cycloid. NOMEIDÆ, CXXVIII.

*tt.* Scales firm, each one with a median ridge. STEINEGERIIDÆ, CXXXIII.

*ss.* Spinous dorsal little developed, of 3 or 4 weak and slender spines continuous with the soft rays; dorsal fin beginning behind the head; body ovate; scales firm, not very small; hypercoracoid very large, entering ventral outline, intervening between the very short pelvic bone and the shoulder girdle. BRAMIDÆ, CXXXII.

*rr.* Dorsal fin without spinous part, all the rays branched and articulate.

*u.* Dorsal beginning as a crest on the head; body oblong; scales very small. CORYPHÆNIDÆ, CXXIX.

*uu.* Dorsal beginning above the axil of the pectoral; caudal rounded or merely emarginate; skeleton without firmness, soft like a wet rag; dorsal spines few or none. ICOSTEIDÆ, CXXXVI.

*jj.* Anal fin excessively long, more than twice as long as dorsal; scales well developed; dorsal spines few, graduated. PEMPHERIDÆ, CXXXIX.

*hh.* Scales firm, linear, parchment-like; body compressed; spinous dorsal short; bones of head rough; mouth small. GRAMMICOLEPIDÆ, CXXXVII.

*hhh.* Scales hard, bony, arranged in oblique spirals; tail with 2 keels; teeth in jaws comb-like; body oblong. TETRAGONURIDÆ, CXXXVIII.

## Family CXVIII. SCOMBRIDÆ.*

### (THE MACKERELS.)

Body elongate, fusiform, not much compressed, covered with minute cycloid scales, the scales anteriorly sometimes forming a corselet. Lateral line present, its course undulate. Head subconic, pointed anteriorly.

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* For a review of the Mackerels (*Scombrinæ*) of America and Europe, see Dresslar and Fesler in Bull. U. S. Fish Comm., VII, 1887 (1889), 429 to 446.

Mouth rather large, with lateral cleft; premaxillary not protractile; maxillary without supplemental bone; jaws with sharp teeth, large or small. Vomer and palatines toothed or not. Preopercle entire; opercle unarmed. In the very young the preopercle is armed with radiating spines, which are later absorbed and lost. Gill openings very wide, the membranes not united, free from the isthmus. Gill rakers usually long. Pseudobranchiæ present, large. Gills 4, a slit behind the fourth. Branchiostegals 7. Dorsal fins 2, the first of rather weak spines, depressible in a groove, the second similar to the anal; the elevated anterior lobe always distinct; anal spines weak; last rays of dorsal and anal detached and separate, forming in each case a series of finlets; caudal peduncle extremely slender, keeled, the caudal lobes abruptly diverging, falcate, the fin adapted for rapid motion; ventral fins well developed, thoracic, I, 5. Vertebræ in greater number than in *Carangidæ*, the number ranging from 31 to 66. First upper pharyngeal present, without teeth; second with teeth; third and fourth coossified, with teeth; lower pharyngeals separate. Stomach sac-shaped. Pyloric cœca numerous. Air bladder small, sometimes absent. Coloration metallic, often brilliant, the prevailing shade steel blue. Genera about 12; species about 60. Fishes of the high seas, many of them cosmopolitan, and all having a wide range; most of them are valued as food-fishes, the flesh being firm and oily, but sometimes coarse. (*Scombridæ*, part, Günther, Cat., II, 349–373.)

SCOMBRINÆ:

*a.* Caudal peduncle without median keel on each side; dorsal fins well separated, the interspace being less than half length of head; spinous dorsal short, of 9 to 12 spines; body scaly; vertebræ normally formed; slender teeth on vomer and palatines; maxillary entirely covered by preorbital; a fleshy lobe on each side of lower jaw near its junction with maxillary; corselet very small or obsolete; gill rakers long, slender, and numerous; pectorals inserted high, on level of eye; vertebræ 14 + 17 = 31. SCOMBER, 388.

*aa.* Caudal peduncle with median keel; a small keel above and one below this; pectoral usually inserted below eye.

SARDINÆ:

*b.* Dorsal spines 10 to 16; gills normal, the laminæ not forming a network; teeth entire.

  *c.* Body scaleless, excepting about the lateral line and corselet; abdominal vertebræ with their lower foramina enlarged, and a portion between the vertebræ proper and the hæmapophyses developed in the form of a network or trellis.

    *d.* Dorsals well separated, the interspace more than half head; corselet well developed; teeth small, some present on vomer, none on palatines; gill rakers long, slender, and numerous; pectorals rather high; vertebræ 39. AUXIS, 389.

    *dd.* Dorsals contiguous, the interspace more than 5 in head; palatine teeth villiform; pectorals low.

      *e.* Vomer toothless; dorsal spines 15 or 16; vertebræ 38. GYMNOSARDA, 390.

  *cc.* Body wholly covered with small scales, those on the corselet and lateral line sometimes larger; dorsal spines 14 to 26; vertebræ normally formed, not as in *Auxis* and *Gymnosarda*.

    *f.* Teeth of jaws slender, subconical, little, if at all, compressed; gill rakers numerous; corselet distinct; pectorals inserted low.

      *g.* Vomer and palatines with villiform or sand-like teeth; body robust, not compressed; vertebræ 39 to 41.

        *h.* Pectoral short, not reaching much beyond tip of the moderate ventral; size enormous. THUNNUS, 391.

        *hh.* Pectoral very long, ribbon-shaped, reaching much beyond front of anal; size moderate. GERMO, 392.

*gg.* Vomer toothless; palatines with a single row of rather strong, conical teeth; body elongate, slightly compressed; vertebræ 50 to 54. SARDA, 393.

*ff.* Teeth of jaws strong, subtriangular or knife-like, more or less compressed; villiform teeth on vomer and palatines; gill rakers comparatively few; corselet obscure; pectorals inserted near level of eye; dorsal spines 14 to 18; body elongate, compressed; head short: snout short; vertebræ 45. SCOMBEROMORUS, 394.

ACANTHOCYBIINÆ:

*bb.* Dorsal spines about 25; gills with the laminæ forming a network as in *Xiphias*; teeth large, compressed, serrated.

*i.* Dorsal spines 24 to 26; body elongate, fusiform; snout long; vertebræ 32 + 34 = 66. ACANTHOCYBIUM, 395.

## 388. SCOMBER (Artedi) Linnæus.

### (MACKERELS.)

*Scomber* (ARTEDI) LINNÆUS, Syst. Nat., Ed. x, 297, 1758, (*scombrus*).
*Cordylus*, GRONOW, Cat. Fishes, 163, 1854, (*scombrus*),
*Pneumatophorus*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 593, (*pneumatophorus*).

Body fusiform, rather elongate, somewhat compressed; caudal peduncle slender, without median keel, but with two small keels on each side. Mouth wide, with a single row of rather small, slender teeth in each jaw and on the vomer and palatines; maxillary slipping under the broad preorbital, a fleshy lobe on each side of lower jaw near its junction with maxillary. Scales very small, not forming a corselet. First dorsal of 9 to 12 feeble spines, separated from the second by an interspace greater than the base of the fin; second dorsal small, followed by 5 to 9 detached finlets; anal similar to second dorsal, with similar finlets; pectorals and ventrals small, the former placed high, on the level of the eyes; caudal fin small, widely forked. Pyloric appendages exceedingly numerous. Air bladder small or wanting. Vertebræ normally formed, 14 + 17 = 31. Gill rakers long and slender. Species few, widely distributed, usually swimming in large schools; carnivorous and migratory; everywhere highly valued for food. (*σκόμβρος*, *Scomber*, the ancient name of the common mackerel.)

SCOMBER:

*a.* Air bladder wanting.

*b.* Dorsal spines 11 or 12; sides of body below median line silvery. SCOMBRUS, 1252.

PNEUMATOPHORUS (*πνεῦμα*, air; *φορέω*, to bear):

*aa.* Air bladder present.

*c.* Dorsal spines 9 or 10; sides of body below median line in adult mottled. COLIAS, 1253.

### Subgenus SCOMBER.

### 1252. SCOMBER SCOMBRUS, Linnæus.

### (COMMON MACKEREL.)

Head 3; depth 3½; eye less than snout, 5 in head. D. XI-12-V; A. I, 11-V. Skull with inconspicuous parallel ridges; suborbital somewhat triangular, posterior border of eye not covered by radiating scales; first dorsal about as high as long, height of second about ⅓ its length; a groove connecting dorsals; air bladder wanting. Snout rather long and pointed, compressed. Mouth large, maxillary extending to anterior margin of orbit. Ventrals and pectorals short, the former nearly half length of head. Lustrous dark blue above, with about 35 wavy, blackish, transverse streaks; below silvery; base of pectorals dark; base of preopercle with about 15 or 20 small black specks or mucous pores, generally arranged in a single row; both dorsals margined with white. Length 18 inches. North Atlantic; abundant on both coasts, north to Norway and Labrador; south to Spain and Cape Hatteras. One of the best known food-fishes of America and Europe. (Eu.)

*Scomber scombrus*, LINNÆUS, Syst. Nat., Ed. x, 297, 1758, Atlantic; after *Scomber pinnulis V* of ARTEDI; JORDAN & GILBERT, Synopsis, 424, 1883; DRESSLAR & FESLER, *l. c.*, 431, 1889.

*Scomber vernalis*, MITCHILL, Trans. Lit. and Philos. Soc. N. Y., 1815, 423, Sandy Hook, New Jersey.

*Scomber scomber*, LINNÆUS, Syst. Nat., Ed. XII, 492, 1766; after ARTEDI; GÜNTHER, Cat., II, 357, 1860.

### Subgenus PNEUMATOPHORUS, Jordan & Gilbert.

### 1253. SCOMBER COLIAS, Gmelin.*

(CHUB MACKEREL; TINKER MACKEREL; EASTER MACKEREL; THIMBLE-EYED MACKEREL; SPANISH MACKEREL OF ENGLAND.)

Head 3; depth 3¼; eye 4 in head, nearly equal to snout. D. IX–I, 12–V or VI; A. I–I, 11–V or VI; scales 200. Head rather pointed; ridges of skull evident but not parallel; subopercle rather more elliptical than triangular; posterior border of eye covered with large radiating scales; top of head with a large translucent area; no groove connecting dorsals; the first dorsal higher than long, the last spines short and weak; second dorsal twice as long as high. Maxillary reaching front of pupil. Pectoral ⅖ length of head. Blue, with about 30 wavy, blackish streaks which extend to just below the lateral line; some of these form reticulations, and inclose pale spots of the color of the back; more than 20 black specks or mucous pores on base of preopercle, generally arranged in more than one row; belly and sides silvery, but always in the adult with roundish dusky spots or cloudings; a black axillary spot. Atlantic and Pacific oceans, widely distributed, north to England, Maine, and San Francisco; very common in the Mediterranean and in southern California; irregular in its appearance on our Atlantic Coast. Smaller than the common mackerel and inferior to it, although a food-fish of importance. The Pacific Coast form called *Scomber diego* differs in no tangible character. (*colias*, an old name of some mackerel.) (Eu.)

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* A supposed hybrid between *Scomber scombrus* and *Scomber colias* was obtained at Block Island, off Rhode Island, by Dr. Seth E. Meek. The following are its characters:

Head 4 in length to fork of caudal fin; eye 5 in head. D. XII, I-10-IV; A. I, 11-IV. Body robust, as in *colias*. Caudal peduncle round, as in *colias*, rather than depressed, as in *scombrus*. No longitudinal groove between the dorsals. A black axillary spot Snout more like *scombrus* than *colias*. Ventrals and pectorals short. Hindmost finlets double, as is the case with *S. scombrus*. Ridges on its head are in three parallel lines, as in *scombrus*, not as in *colias*. Subopercle more elliptical than triangular. Posterior border of eye not covered with large radiating scales. Top of head, as in *S. scombrus*, without translucent area. About 20 small black specks or pores at base of preopercle, arranged in a single row. Coloring on the back in blotches, as in *colias*, rather than in stripes, as in *scombrus*. Sides mottled, much as in *colias*. Base of pectorals dark. The following note was made by Dr. Meek: "September 16, Block Island.—A peculiarly marked *Scomber scombrus*, only four finlets, no air bladder, low spinous dorsal, and markings of *S. colias*. Mr. Blackford thinks it is a cross between the two." Length 13½ inches.

*Lacerto*, Cetti, Hist. Nat. Sard., III, 190, 1774, Sardinia.
*Scomber colias*, Gmelin, Syst. Nat., 1329, 1788, Sardinia; based on *Lacerto* of Cetti.
*Scomber lacertus*, Walbaum, Art. Pisc., 209, 1792, Sardinia; after Cetti.
*Scomber pneumatophorus*, De la Roche, Ann. Mus. Nat. Hist., XIII, 315 and 334, 1809, Balearic Islands.
*Scomber macrophthalmus*, Rafinesque, Indice d'Ittiologia Siciliana, 15, 1810, Palermo.
*Scomber grex*, Mitchill, Trans. Lit. and Philos. Soc. N. Y., 1815, 422, New York.
*Scomber maculatus*, Couch, Mag. Nat. Hist., v, 22, 1832, England.
*Scomber undulatus*, Swainson, Nat. Hist. Fishes, II, 409, 1839, Sicily.
*Scomber gracilis*, Swainson, Nat. Hist. Fishes, II, 410, 1839, Sicily.
*Scomber diego*, Ayres, Proc. Cal. Ac. Sci., 1856, 92, Santa Barbara.
*Scomber dekayi*, Storer, Fishes Mass., 130, 1867, Massachusetts coast.
*Scomber colias*, Dresslar & Fesler, *l. c.*, 432, 1889.

## 389. AUXIS, Cuvier.

(Frigate Mackerels.)

*Auxis*, Cuvier, Règne Anim., Ed. II, Vol. 2, 119, 1829, (*rochei*).

Body oblong, plump, mostly naked posteriorly, anteriorly covered with small scales, those of the pectoral region enlarged, forming a corselet. Snout very short, conical, scarcely compressed. Mouth rather small, the jaws equal. Teeth very small, mostly in a single series, on the jaws only. Tail very slender, depressed, with a rather large keel on each side. First dorsal short, separated from the second by a considerable interspace. Second dorsal and anal small, each with 7 or 8 finlets. Pectorals and ventrals small. No air bladder. Branchiostegals 7. Pyloric cœca dendritical. Gill rakers very long and slender, numerous. Vertebræ 39 in number, peculiarly modified, essentially as in *Gymnosarda*. One species, pelagic, widely distributed. (*αὔξις*, an ancient name of a young tunny, from *αὐξάνω*, to grow.)

### 1254. AUXIS THAZARD (Lacépède).

(Frigate Mackerel.)

Head 4; depth 4¼; eye 5; snout 5. D. X-12-VIII; A. VII-13; Vert. 39. Body robust, scarcely compressed, abruptly contracted at caudal peduncle. Opercle very broad. Scales of corselet and along anterior dorsal region comparatively large. Maxillary almost entirely concealed by preorbital. Dorsal spines rather stiff; space between dorsals ⅘ length of head. About 33 gill rakers below angle. Pectoral reaching past middle of first dorsal. Blue, variegated with darker above, becoming plain with age; belly silvery. All warm seas, occasionally northward to Cape Cod. This species is very erratic in its movements, swimming in large schools in various warm seas. It rarely reaches the coasts of the United States, but it occasionally comes in immense numbers. It is a poor fish, of little value as food. (*Thazard*, from the French Tassard, a name applied to the species of *Scomberomorus*.)

*Scomber thazard*, Lacépède, Hist. Nat. Poiss., III, 9, 1802, 6° and 7° S. latitude, coast of New Guinea.
*Scomber rochei*, Risso, Ichth. Nice, 165, 1810, Nice.
*Scomber bisus*, Rafinesque, Caratteri, etc., 45, 1810, Palermo.

*Thynnus rocheanus*, RISSO, Eur. Mérid., III, 417, 1827, Nice.
*Auxis vulgaris*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., VIII, 139, 1831, Mediterranean.
*Auxis tapeinosoma*, BLEEKER, Fauna Japan, 408, 1854, Japan.
*Auxis thynnoides*, BLEEKER, Ternate, V, 301, 1855, Ternate.
*Auxis rochei*, GÜNTHER, Cat., II, 369, 1860.
*Auxis thazard*, JORDAN & GILBERT, Synopsis, 425, 1883.

## 390. GYMNOSARDA, Gill.

### (LITTLE TUNNIES.)

*Gymnosarda*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 125, (*unicolor*).
*Thynnus*, LÜTKEN, Spolia Atlantica, 460, 1880, (*pelamys*); not of CUVIER & VALENCIENNES.
*Thynnichthys*, GIGLIOLI, Catal. Pesci Italiana, 25, 1880, (*thunnina*, not *Thynnichthys* of BLEEKER, a genus of *Cyprinidæ*).
*Euthynnus*, LÜTKEN, MS. (in Epist. Feb. 1881); JORDAN & GILBERT, Synopsis, 429, 1883, (*thunnina*).

This genus according to Lütken* differs from *Thunnus*† (1) in the absence of teeth on vomer; (2) by the complete absence of scales outside of the corselet, while in *Thunnus* of the same size the skin is covered with small scales; the limits of the corselet in the Tunny and Albicore are obscure, so that it can not properly be said that they have distinct corselets; and (3) by an important osteological character, namely the peculiar development, in the form of a network or trellis, of a portion of the abdominal part of the backbone, between the vertebræ proper and the hæmapophyses. Vertebræ 38. Species of smaller size than the Tunnies, also pelagic, and of little value as food. (*γυμνός*, naked; *σάρδα*, a kind of tunny caught about Sardinia; *Sarda*.)

| | |
|---|---|
| *a.* Lateral line with a decided curve below second dorsal; 4 lengthwise stripes on sides of body below lateral line. | PELAMIS, 1255. |
| *aa.* Lateral line without distinct curve; no stripes below lateral line. | ALLETERATA, 1256. |

### 1255. GYMNOSARDA PELAMIS (Linnæus).

#### (OCEANIC BONITO.)

Head 3½; depth 4. D. XV-12-VIII; A. II, 12-VII. Body oblong, robust. Lateral line making a decided curve immediately beneath the second dorsal. Corselet strongly developed, covering the entire space between the diagonals connecting the posterior extremity of the spinous dorsal and the base of the pectorals. Posterior margin of preopercle about 1½ in inferior margin. Pectorals reach vertical from tenth dorsal spine. Back bluish; belly silvery; 4 brownish stripes on each side of belly, parallel with the lower curve of body; no spots below pectorals. Warm seas; pelagic; not very common; north to Cape Cod and Bermudas on the Atlantic Coast of America, once recorded from California.‡ (*πηλαμύς*, tunny.) (Eu.)

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*Spolia Atlantica, 596, 1880.

† We follow Dresslar and Fesler in uniting *Euthynnus* and *Gymnosarda*, because the external characters of *Euthynnus* are all shown by *Gymnosarda nuda*, the Asiatic type of the latter genus, *Gymnosarda*. Probably the skeletons are also similar.

‡ See Eigenmann, Proc. Cal. Ac. Sci., III, 1889, 8.

*Scomber pelamis*, Linnæus, Syst. Nat., Ed. x, 297, 1758, "in Pelago inter Tropicos."
*Scomber pelamides*, Lacépède, Hist. Nat. Poiss., iii, 14, 1802; after Linnæus.
*Thynnus pelamys*, Cuvier & Valenciennes, Hist. Nat. Poiss., viii, 113, 1831.
*Thynnus pelamis*, Steindachner, Ichth. Berichte, v, 7, 1868.
*Orcynus pelamys*, Poey, Synopsis, 362, 1868; Goode & Bean, Proc. U. S. Nat. Mus., 1878, 24.
*Euthynnus pelamys*, Jordan & Gilbert, Synopsis, 430, 1883.
*Gymnosarda pelamis*, Dresslar & Fesler, *l. c.*, 436, 1889.

### 1256. GYMNOSARDA ALLETERATA (Rafinesque).

(Little Tunny; Bonito.)

Head 3¾; depth 4¼. D. XV-I, 12-VIII; A. 12-VII. Body fusiform, robust. Lateral line nowhere making a very distinct curve. Corselet well developed, not covering the entire space between the diagonals connecting the posterior extremity of spinous dorsal and base of pectorals. Posterior margin of preopercle about 2 in inferior margin. Pectorals reaching vertical from ninth dorsal spine. Bluish above; sides and belly silvery; no stripes of any kind below lateral line; above lateral line several wavy, oblique streaks; 5 round black spots about as large as pupil below pectoral. Warm seas, occasionally northward to Cape Cod; common in the West Indies and the Mediterranean; not recorded from California. (*Alleteratu*, a local name in use at Palermo.) (Eu.)

*Scomber alletteratus*, Rafinesque, Caratteri Alcuni Genere, etc., 46, 1810, Palermo.
*Thynnus leachianus*, Risso, Eur. Mérid., iii, 414, 1826, Nice.
*Scomber quadripunctatus*, Geoffrey St. Hilaire, Descr. Egypt. Poiss., pl. 24, fig. 3, 1827, Egypt.
*Thynnus thunnina*, Cuvier & Valenciennes, Hist. Nat. Poiss., viii, 104, 1831, Mediterranean.
*Thynnus brasiliensis*, Cuvier & Valenciennes, Hist. Nat. Poiss., viii, 110, 1831, Brazil.
*Thynnus brevipinnis*, Cuvier & Valenciennes, Hist. Nat. Poiss., viii, 112, 1831, Mediterranean.
*Orcynus alliteratus*, Gill, Cat. Fish. East Coast N. A., in Rept. U. S. Fish Comm., 802, 1873.
*Euthynnus alliteratus*, Jordan & Gilbert, Synopsis, 430, 1883.
*Thynnichthys thunnina*, Giglioli, Cat. dei Pesci Italiani, 25, 1880.
*Orcynus thunnina*, Poey, Enumeratio, 72, 1875.
*Thynnus affinis*, Cantor, Cat. Malay Fishes, 106, 1850, Sea of Pinang.
*Thynnichthys brevipinnis*, Giglioli, Cat. dei Pesci Italiani, 25, 1880.

## 391. THUNNUS, South.

(Great Tunnies.)

*Thynnus*, Cuvier, Règne Animal, Ed. i, 313, 1817, (*thynnus*; not of Fabricius, 1775, a genus of Butterflies).
*Thunnus*, South, Encyclop. Metropol., v, 620, 1845, (*thynnus*); (fide Gill).
*Orycnus*, Cooper, Proc. Cal. Ac. Nat. Sci., 1863, 77, (*thynnus*; not *Orycnus*, Gill, 1861, which was originally a misprint for *Orcynus*).
*Albacora*, Jordan, Man. Vert., Ed. v, 106, 1888, (*thynnus*).

Body oblong, robust, with very slender caudal peduncle. Head conical. Mouth wide, with one series of small, conical teeth in the jaws and bands of minute villiform or sand-like teeth on the vomer and palatines. Scales present, those of the pectoral region forming an obscure corselet. First dorsal of 12 to 15 spines which grow gradually shorter backward, the interval between last spine and second dorsal slight; second dorsal and anal short and rather high, each with 8 to 10 finlets; ventrals moderate; pectorals moderate, inserted rather below the level of the eye. Vertebræ normal, 39 to 41 in number, the lower foramina very small. Open seas; the single species widely distributed and attaining a very great size. (*θύννος. Thunnus* or *Thynnus*, an old name of the Tunny.)

### 1257. THUNNUS THYNNUS (Linnæus).

(Tunny; Horse Mackerel; Great Albacore; Tuna.)

Head 3¾; depth 4. D. XIV–I, 13–IX; A. I, 12–VIII. Body oblong, very robust; corselet well developed, extending farther back than pectorals; caudal keel extending forward to second finlet from caudal. Mouth rather large; maxillary reaching pupil; posterior margin of preopercle somewhat shorter than inferior. Eye small. Dorsal and anal falcate, short, 2 in height of first dorsal; ventrals longer than anal, caudal very widely forked; pectorals short, reaching to about ninth dorsal spine. Dark blue above; below grayish, with silvery spots. Pelagic, found on all warm coasts; north to England, Newfoundland, San Francisco, and Japan. The largest of the *Scombridæ*, reaching a length of 10 feet or more and a weight of 1,500 pounds. Occasionally taken along the California coast, a specimen 8 feet long, from Monterey, examined by us. The flesh is excellent, that even of very large individuals being of fine flavor. The subject of extensive fisheries in Europe. (*ϑύννος*, an old name, whence Tunny, *Tuna*, *Thon*, etc.) (Eu.)

*Scomber thynnus*, Linnæus, Syst. Nat., Ed. x, 297, 1758, Europe; based on *Scomber pinnulis* 8 *seu* 9, of Artedi.

*Scomber albacores*, Bonnaterre, Encyc. Ichth., 140, 1788, Jamaica; based on Sloane.

*Thynnus mediterraneus*, Risso, Eur. Mérid., iii, 414, 1826, Nice.

*Thynnus vulgaris*, Cuvier & Valenciennes, Hist. Nat. Poiss., viii, 58, pl. 210, 1831, European seas.

*Thynnus brachypterus*, Cuvier & Valenciennes, Hist. Nat. Poiss., viii, 98, pl. 211, 1831, Mediterranean.

*Thynnus coretta*, Cuvier & Valenciennes, Hist. Nat. Poiss., viii, 102, 1831, Caribbean Sea.

*Scomber sloanei*, Cuvier & Valenciennes, Hist. Nat. Poiss., viii, 148, 1831, Jamaica; based on Sloane.

*Thynnus secundo-dorsalis*, Storer, Fishes Mass., 143, 1867, Cape Ann and Provincetown.

*Orcynus schlegelii*, Steindachner & Döderlein, Beiträge zur Kenntniss der Fische Japan, iii, 11, pl. 3, fig. 1, 1885, Tokio.

*Orcynus thynnus*, Jordan & Gilbert, Synopsis, 429, 1883.

*Albacora thynnus*, Dresslar & Fesler, *l. c.*, 439, 1889.

## 392. GERMO, Jordan.

(Albacores.)

*Orcynus*, Cuvier, Règne Animal, Ed. i, 314, 1817, (*alalonga*); not *Orcynus* of Rafinesque, Analyse de la Nature, 1815, which is equivalent to *Scomberoides*.

*Germo*, Jordan, Proc. Ac. Nat. Sci. Phila., 1888, 180, (*alalonga*).

Pectoral fins very long, saber-shaped, their length in the adult about ⅖ the length of the body. Otherwise essentially as in *Thunnus*, to which the genus is very closely related. Size large, but much less than that of the species of *Thunnus*. (*Germon*, the French name of the long-finned *Albacore*.*)

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*Albacore is from *Albacora*, a Portuguese name said to be from the Arabic *al* a, and *bacora*, little pig. It should not be spelled *Albicore*, as it is not connected with *albus*, white.

### 1258. GERMO ALALUNGA (Gmelin).

(LONG-FINNED ALBACORE; ALBECOR; ALILONGHI; GERMON.)

Head 3¼; depth 3½. D. XIV-II, 12-VIII; A. II, 12-VII. Body little compressed, regularly elliptical, its weight great in proportion to length. Tail strongly keeled, broader than deep, the keel extending forward to fifth finlet from last. Corselet small, indistinct. Scales rather large. Dorsal and anal of equal height; pectoral very long, saber-shaped, reaching to first of the dorsal finlets, shorter in the young, inserted a little below level of pupil, its base a little wider than the large eye; ventrals short. Metallic steel-blue; belly silvery; fins dark, with metallic luster. Tropical seas; pelagic and widely distributed. Rarely seen on the Atlantic Coast of America, but very common in the Mediterranean. It is found on the Pacific Coast as far north as San Francisco, and is extremely abundant in the spawning season about the Santa Barbara Islands. As a food-fish it is of little value, the flesh being coarse and oily, far inferior to that of the Tunny. Length 3 feet; weight 15 to 20 pounds. (*Alalunga*, a name used in Sardinia, from *ala*, wing; *longus*, long.) (Eu.)

*Ala-lunga*, CETTI, Hist. Nat. Sard., III, 191, 1777, Sardinia.

*Scomber alatunga*, GMELIN, Syst. Nat., 1330, 1788, (Sardinia; based on *Cetti*; misprint for "*alalunga*").

*Scomber germo*, LACÉPÈDE, Hist. Nat. Poiss., II, 598, and III, 1, 1802, 17° S. latitude and 103° W. longitude.

*Thynnus atlanticus*, LESSON, Voy. Coquille, Zoöl., II, 165, 1828, Atlantic Ocean.

*Thynnus balteatus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., VIII, 136, 1831, tropical parts of Atlantic.

*Thynnus pacificus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., VIII, 133, 1831, 27° and 26° S. latitude, 103° W. longitude.

*Thynnus argenti-vittatus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., VIII, 134, 1831, Atlantic and the Indies.

*Thynnus albacora*, LOWE, Proc. Zoöl. Soc. Lond., 1839, 77, Madeira.

*Thynnus macropterus*, TEMMINCK & SCHLEGEL, Fauna Japan, Poiss., 98, pl. 51, 1850, Japan.

*Orcynus subulatus*,[*] POEY, Enumeratio, 71, 1875, Cuba.

*Orcynus alalonga*, JORDAN & GILBERT, Synopsis, 428, 1883.

*Albacora alalonga*, DRESSLAR & FESLER, *l. c.*, 438, 1889.

## 393. SARDA, Cuvier.

(BONITOS.)

*Sarda*, CUVIER, Règne Anim., Ed. 2, II, 199, 1829, (*pelamys* = *sarda*).

*Pelamys*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., VIII, 149, 1831, (*sarda*); not *Pelamys* of DAUDIN, a genus of snakes.

Body rather elongate, covered with small scales, those of the pectoral region forming a corselet. Caudal peduncle slender, strongly keeled. Head large, pointed, compressed. Mouth large. Teeth in the jaws rather strong, conical, slightly compressed; similar teeth on the palatines, but none on the vomer; maxillary not concealed by preorbital. Gill rakers long and strong. First dorsal long and rather low, of 18 to 22 rather stout spines, which are gradually shortened behind; interval between the last spine and the second dorsal short; second dorsal small, followed by 8–9 finlets; anal fin similar, usually with one less finlet; paired fins small; pectorals placed below the level of the pupil. No air bladder. Pyloric cœca very numerous, dendritical. Vertebræ normally formed, 50 to 54 in number. Fishes of rather large size, of metallic coloration. (*Sarda*; *σάρδα*, the ancient name of the typical species, also known as *Amia*, *Pelamys*, etc.; so called from its being taken in the neighborhood of the island of Sardinia; hence, also, the diminutive *σαρδίνη*, the Sardine.)

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[*] Poey, in describing *Orcynus subulatus*, says the pectoral in *subulatus* is 1⅔ in anal, 5 in total to base of caudal, ½ in ventral, $\frac{6}{7}$ in head. Dr. Lütken unites other doubtful species, *albicora*, *pacificus*, *germo*, etc., with *alalunga*, but hesitates to do the same with *subulatus* only on account of the length of its pectoral, which he thinks is a little too long for *thynnus* and not nearly long enough for *alalunga*.

| | |
|---|---|
| *a.* Dorsal spines 21; maxillary reaching beyond orbit. | SARDA, 1259. |
| *aa.* Dorsal spines 18; maxillary not reaching beyond orbit. | CHILENSIS, 1260. |

### 1259. SARDA SARDA (Bloch).

(Bonito.)

Head 3¾; depth 4. D. XXI-I, 13–VIII; A. I, 13–VII; P. 10. Body elongate, moderately compressed, robust; corselet distinct, small, not extending beyond pectoral. Teeth moderate, slightly compressed, about 30 in each jaw. Gill rakers rather small, 11 or 12 below angle. Maxillary reaching beyond orbit. Lateral line slightly undulating, with nowhere a decided curve. Dark steel blue above, with numerous narrow, dark stripes from the back obliquely downward and forward from the back; silvery below. Length 2½ feet; weight from 10 to 12 pounds. Atlantic Ocean, on both coasts, north to Cape Cod; very abundant; a food-fish of rather low grade. This species seems to inhabit the open ocean, approaching the shores for food or purposes of spawning. (Eu.)

*Scomber pelamys*, Brünnich, Ichth. Massil., 69, 1768, Marseilles; not of Linnæus.
*Scomber sarda*, Bloch, Ichthyologia, x, 35, pl. 334, 1793, Europe.
*Scomber mediterraneus*, Bloch & Schneider, Syst. Ichth., 23, 1801, Marseilles; after Brünnich.
*Scomber pelamitus*, Rafinesque, Caratteri, 44, pl. 2, 1810, Palermo.
*Pelamys sarda*, Günther, Cat., ii, 367, 1860, and of most European writers.
*Sarda mediterranea*, Jordan & Gilbert, Synopsis, 427, 1883.
*Sarda sarda*, Dresslar & Fesler, *l. c.*, 440, pl. viii, 1889.

### 1260. SARDA CHILENSIS, Cuvier & Valenciennes.

(California Bonito; Skipjack.)

Head 3¾; depth 4¾. D. XVIII-I, 12–VIII; A. II, 11–VI. Head pointed, conical, naked. Maxillary not reaching eye. Teeth strong, curved, about 40 in each jaw. Pectorals placed just below the level of pupil, scarcely half as long as head. Gill rakers long, strong, 16 or 17 below angle. Corselet moderately developed. Lateral line undulating, making a sharp curve below soft dorsal. Dark metallic blue; sides dusky; several blackish stripes running obliquely upward and backward from the pectoral region to the upper edge of the tail, these variable in number and direction. Length 2 to 3 feet; weight 16 pounds. San Francisco to Patagonia and Japan; abundant northward in summer; very similar to the preceding, but with the spinous dorsal always shorter, its flesh similarly coarse, dark red, and oily. (*chilensis*, living in Chile.)

*Pelamys chilensis*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., VIII, 163, 1831, Valparaiso; GÜNTHER, Cat., II, 368, 1860.
*Pelamys orientalis*, TEMMINCK & SCHLEGEL, Fauna Japan, Poiss., 99, pl. 52, 1850, Japan.
*Pelamys lineolata*, GIRARD, Pac. R. R. Surv., X, 106, 1858, San Diego, California.
*Sarda chilensis*, JORDAN & GILBERT, Synopsis, 428, 1883; DRESSLAR & FESLER, *l. c.*, 441, 1889.

## 394. SCOMBEROMORUS,* Lacépède.

*Scomberomorus*, LACÉPÈDE, Hist. Nat. Poiss., III, 292, 1802, (*plumierii*).
*Cybium*, CUVIER, Règne Anim., Ed. 2, II, 1829, 120, (*commersonii*).
*Apodontis*, BENNETT, Proc. Comm. Zoöl. Soc., I, 169, 1831, (*immunis*).
*Lepidocybium*, GILL, Proc. Ac. Nat. Sci. Phila , 125, 1862, (*flavobrunneum*).
*Chriomitra*, LOCKINGTON, Proc. Ac. Nat. Sci. Phila., 1879, 133, (*concolor*).
*Scomberodon*, VAN BENEDEN, (fossil).

Body elongate, wholly covered with rudimentary scales, which do not form a distinct corselet. Head pointed, comparatively short and small. Mouth wide, the strong teeth in the jaws more or less compressed or knife-shaped; villiform or sand-like teeth on the vomer and palatines; maxillary not concealed by preorbital. Gill rakers few. Caudal peduncal with a single keel. Spinous dorsal low, of 14 to 18 feeble spines. Soft dorsal and anal short, similar, somewhat elevated and falcate, each followed by 7 to 10 finlets; ventrals small; pectorals moderate, near the level of the eye. Air bladder present. Vertebræ normally formed, 45 in number. Fishes of the high seas; graceful in form and beautiful in color; among the best of food-fishes. (σκόμβρος, Scomber; ὅμορος, near.)

*a.* Males with sides silvery, no spots; females with 2 rows of brown spots, fins nearly plain. CONCOLOR, 1261.
*aa.* Both sexes with numerous bronze spots on sides; spinous dorsal dark except at base.
  *b.* Soft dorsal inserted in advance of anal. MACULATUS, 1262.
  *bb.* Soft dorsal inserted over anal.
    *c.* Body deep, the depth less than 5 in length
      *d.* Teeth 26 to 32 in each jaw. SIERRA, 1263.
      *dd.* Teeth about 40 in each jaw. REGALIS, 1264.
    *cc.* Body more slender; the depth about 6 in length. CAVALLA, 1265.

### 1261. SCOMBEROMORUS CONCOLOR (Lockington).

(MONTEREY SPANISH MACKEREL.)

Head about 5; depth rather less; eye 5½. D. XVII-16-VIII; A. I, 16-VIII. Mouth slightly oblique, the maxillary reaching to posterior margin of pupil. Teeth of jaws comparatively small, subconical, little compressed; about 50 in each jaw; those of vomer and palatines minute and granular. Lateral line slightly wavy, descending obliquely. Pectoral fins 8 in length, inserted rather above axis of body; ventral fins small; spines of dorsal slender and fragile, the longest ¼ as long as head; dorsal fins separated by an interspace equal to ⅓ length of base of spinous dorsal; caudal shorter than head, its lower lobe longest. Gill rakers long, 18 below angle. Male dark steel blue, the sides silvery, without streaks or spots; female with two alternate series of brown spots, the silvery on sides clouded with dusky; fins nearly plain, dark. Monterey Bay, California; appearing about Santa Cruz in moderate numbers each fall; not known elsewhere, and always disappearing in November. A food-fish of very high quality, not inferior to any other of the family. (*concolor*, uniformly colored.)

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* For an account of the species of *Scomberomorus* see a paper by Meek & Newland, Proc. Ac. Nat. Sci. Phila., 1884, 232-235.

*Chriomitra concolor*, LOCKINGTON, Proc. Ac. Nat. Sci. Phila., 1879, 133, Monterey, California.
*Scomberomorus concolor*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 45, 1881; JORDAN & GILBERT, Synopsis, 426, 1883; MEEK & NEWLAND, *l. c.*, 233, 1884; DRESSLAR & FESLER, *l. c.*, 442, 1889.

### 1262. SCOMBEROMORUS MACULATUS (Mitchill).

(SPANISH MACKEREL.)

Head 4½; depth 4½. D. XVII–18–IX; A. II–17–IX; maxillary 1⅘ in head; eye 4¾; pectoral 1¾; ventral 4½; dorsal and anal lobes subequal, 2. Body elongate, its dorsal and ventral outlines equal; profile straight from snout to dorsal; head small and pointed; mouth large, oblique, jaws equal; maxillary reaching posterior margin of orbit; teeth large, compressed, and sharp, their formula being 24–24 to 32–32; gill rakers 2 + 11. Soft dorsal inserted in advance of anal a distance about equal to diameter of eye; lateral line undulating, with about 175 pores. Color silvery, bluish above; sides with many elliptical spots of dull orange color, two rows of these spots below lateral line and one row above; spinous dorsal white at base, black above; soft dorsal tinged with yellowish, its margins black; anal white; posterior side of pectoral black, anterior side yellowish with black borders; caudal blackish. Both coasts of North America, appearing in large but very irregular schools in the Gulf of Mexico and along the Carolina Coast; ranging north in the fall as far as Cape Ann, and south to Brazil; rare or unknown in Cuba. Weight 8 or 9 pounds. One of the very best food-fishes in the United States. (*maculatus*, spotted.)

*Scomber maculatus*, MITCHILL, Trans. Lit. & Phil. Soc. N. Y., I, 1815, 426, New York.
*Cybium maculatum*, GÜNTHER, Cat., II, 372, 1860; HOLBROOK, Ichth. S. Car., 66, 1860.
*Scomberomorus maculatus*, JORDAN & GILBERT, Synopsis, 426, 1883; MEEK & NEWLAND, *l. c.*, 233, 1885; DRESSLAR & FESLER, *l. c.*, 443, pl. 9, 1889.

### 1263. SCOMBEROMORUS SIERRA, Jordan & Starks.

(SIERRA.)

Head 4¾; depth 4¾. D. XVIII–15–IX; A. II–15–IX; maxillary 1¾ in head; eye 5; pectoral 1¾; ventral 3½; dorsal and anal lobes equal, 1¾ in head. Body elongate, its dorsal and anal outline about equal; profile straight from snout to dorsal; head small and pointed; mouth large, oblique, jaws equal; maxillary reaching to posterior edge of orbit. Teeth large, compressed, and sharp, $\frac{15}{11}$ on each side; gill rakers 4 + 11. Soft dorsal inserted almost directly over front of anal; lateral line undulating, with about 165 pores. Silvery; above dark steel bluish; sides with numerous round spots of the same color as the back, three rows of these spots below lateral line and one above; spinous dorsal all black; soft dorsal tinged with yellowish, its margins black; anal white; posterior face of pectoral entirely black, anterior face yellowish with blackish borders; caudal black. A large example, supposed to be a male, has five rows of spots below the lateral line, anteriorly these spots decreasing in size toward the belly, but extending nearly to base of ventral fin. Length 2½ feet. Pacific Coast of tropical America; generally common, representing *S. maculatus*, which it resembles very closely, the more backward insertion of the soft dorsal and the coloration being the only distinctive characters of importance. The species is not valued as food, but this may be due to the poor ways of cooking fish prevalent in Mexico. (*Sierra*, the vernacular name, meaning saw.)

*Scomberomorus maculatus*, JORDAN & GILBERT, Bull. U. S. Fish Comm., II, 1882, 106; not of MITCHILL.

*Scomberomorus sierra*, JORDAN & STARKS, Rept. Fishes Sinaloa, MS. 1895, Mazatlan. (Type, No. 1720, L. S. Jr. Univ. Mus. Coll. Hopkins Expedition.)

### 1264. SCOMBEROMORUS REGALIS (Bloch).

(SIERRA; PINTADO.)

Head 4½; depth 4½. D. XVII–I, 15–VIII; A. II, 14–VIII. Body rather elongate, its dorsal and ventral curves about equal. Lateral line descending obliquely, undulate along the tail. Mouth large; maxillary reaching to below eye; angle of preopercle produced backward; pectorals scaly; caudal peduncle rather slender, its least depth 5½ in head; caudal less widely forked than in *maculatus*. Teeth triangular, strongly compressed, about 40 in each jaw. Pectoral scaly. Silvery; sides with two blackish longitudinal bands crossing lateral line below soft dorsal, both posteriorly broken with longitudinal spots; above and below these numerous brownish spots in rows persistent in the adult; anterior portion of spinous dorsal black. Cape Cod to Brazil; not very common on our Atlantic Coast; abundant in Cuba, closely allied to *Scomberomorus maculatus*, from which most fishermen do not distinguish it. It reaches a length of 5 or 6 feet and a weight of 20 pounds, it being also an excellent food-fish. (*regalis*, royal.)

*Scomber regalis*, BLOCH, Ichthyol., pl. 333, 1795, Martinique; after a drawing by PLUMIER.

*Scomberomorus plumieri*, LACÉPÈDE, Hist. Nat. Poiss., III, 292, 1806, Martinique; after AUBRIET'S copy of PLUMIER'S drawing.

*Cybium regale*, GÜNTHER, Cat., II, 372, 1860.

*Cybium acervum*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., VIII, 186, 1831, Cuba.

*Scomberomorus regalis*, JORDAN & GILBERT, Synopsis, 426, 1883; MEEK & NEWLAND, *l. c.*, 234, 1885; DRESSLAR & FESLER, *l. c.*, 444, pl. x, 1889.

### 1265. SCOMBEROMORUS CAVALLA (Cuvier & Valenciennes).

(KINGFISH; CAVALLA; CERO; SIERRA.)

Head 5; depth 6; eye large, 2 in snout. D. XV–I, 15–VIII; A. II, 15–VIII. Mouth large, maxillary reaching to below eye. Lateral line descending abruptly below the second dorsal. Teeth triangular, strongly compressed, about 30 on each jaw. Pectoral 5 in body. Gill rakers very short, less than ⅓ diameter of eye, about 8 below the angle. Adult iron gray, nearly or quite immaculate; young with the sides of body marked with darker yellowish spots; spinous dorsal without black blotch anteriorly. Tropical Atlantic, in the open seas, coming in immense numbers to the Florida Keys and Charleston, ranging north to Cape Cod and south to Africa and Brazil; very common on our South Atlantic coast, especially among the Florida Keys, the catch at Key West very large. One of the best food-fishes of the Florida coast, with firm rich flesh. It reaches a length of 5 feet and a weight of 100 pounds. (*Cavalla* or *Caballa*, a Spanish name, from *caballus*, horse.)

*Cybium cavalla*, CUVIER, Règne Anim., Ed. 2, II, 200, 1829, Brazil; after *Guarapucu* of MARCGRAVE.

*Cybium caballa*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., VIII, 187, 1831, Brazil; GÜNTHER, Cat., II, 373, 1860.

*Cybium immaculatum*, CUVIER & VALENCIENNES, *l. c.*, VIII, 191, 1831, no locality.

*Scomberomorus caballa*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 268, 1882; JORDAN & GILBERT, Synopsis, 427, 1883; MEEK & NEWLAND, *l. c.*, 235, 1885.

*Scomberomorus cavalla*, DRESSLAR & FESLER, *l. c.*, 444, pl. XI, 1889.

## 395. ACANTHOCYBIUM, Gill.

### (PETOS.)

*Acanthocybium*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 125, (*sara* = *solandri*).

Body elongate, fusiform. Head very long, slender and pointed, the mandible being longer than upper jaw; jaws forming a sort of beak; cleft of mouth extending to below eye; posterior part of maxillary covered by the preorbital; both jaws armed with a close series of trenchant teeth, ovate or truncate; their edges finely serrate; villiform teeth on vomer and palatines; gills as in *Xiphias*, their laminæ forming a network; scales small, scarcely forming a corselet; those along the base of dorsal enlarged and lanceolate; keel strong; caudal spinous; dorsal very long, its spines about 25 in number. One species, a very large mackerel-like fish, widely distributed; especially abundant about the Florida Straits. This remarkable genus indicates a long step from *Scomberomorus* toward the type of the swordfishes. (*ἄκανθα*, spine; *Cybium*; the name *κύβιον* was originally applied to the cured flesh of *πηλαμίς*).

### 1266. ACANTHOCYBIUM SOLANDRI (Cuvier & Valenciennes).

### (PETO; WAHOO; GUARAPUCU.)

Head 4; depth 6½; eye 5 in snout; gape more than half length of head; premaxillaries in front prolonged in a sort of beak, which is nearly half length of snout; teeth somewhat irregular, the posterior much the largest, all strong, serrated, about 50 in each jaw. Dorsal spines mostly subequal; lateral line descending abruptly under sixteenth dorsal spine; the highest, behind the middle of fin, 5⅔ in head; dorsal and anal lobes low. Caudal lobes short, very abruptly spreading, their length about ⅔ head.

Pectoral 2¼ in head. Corselet small. Steel blue; dark above, paler below; no distinct markings, young faintly barred; fins colored like the body. Tropical seas; not rare about Cuba, where it spawns; north to southern Florida; not rare about the Florida Keys. It reaches a length of 6 feet or more and a weight of over 50 to 100 pounds, and is valued as a food-fish. (Named for its discoverer, Solander, an early explorer.) (Eu.)

*Cybium solandri*, Cuvier & Valenciennes, Hist. Nat. Poiss., VIII, 192, 1831; after MS. of Solander; open sea, exact locality unknown.
*Cybium sara*, Bennett, Beechey's Voyage, Zoöl., 63, pl. 20, fig. 2, 1849, Loo Choo; Günther. Cat., II, 373, 1860.
*Cybium petus*, Poey, Memorias, II, 234, pl. 16, fig. 1, 1860, Havana.
*Cybium verany*, Doderlein, Giorn. di Sc. Nat., Ed. Econ., VIII, 1872, Palermo.
*Acanthocybium petus*, Poey, Synopsis, 363, 1868.
*Acanthocybium solandri*, Jordan, Proc. U. S. Nat. Mus., 1884, 119.

## Family CXIX. GEMPYLIDÆ.

### (The ESCOLARS.)

Mackerel-like fishes with the body rather elongate, more or less compressed, covered with minute scales. Lateral line various, sometimes obsolete, sometimes with a dorsal branch. Head large, compressed, with very strong teeth, usually compressed, some of the anterior canine-like. Lower jaw projecting. Gill openings wide, the membranes not united, free from isthmus. Gills 4, a slit behind fourth. Opercles in adult unarmed; in young the preopercle with radiating spines as usual in scombroid fishes. Dorsal fin long, a notch separating the weak spines from the soft part, which always forms a distinct lobe anteriorly, similar in form to the anal fin. Finlets often present. Caudal peduncle slender, usually not keeled, the fin moderate in size, always forked. Ventrals small, often reduced to a single spine. Vertebræ numerous, 32 to 53 in number. Pyloric cœca rather few. Air bladder usually present. Coloration metallic, usually brilliant. Genera about 6; species about 12. Fishes of the high seas, widely distributed and descending to considerable depths, usually breeding about rocky islands, most of them used as food. The *Gempylidæ* are closely allied to the *Scombridæ*, from which they diverge in the direction of the *Lepidopidæ* and *Trichiuridæ*. The successive steps are indicated by the progressive elongation of the body, the progressive reduction of the ventrals and the vertical fins, and on the other hand by the progressive elongation of the lower jaw and the specialization of the dentition. Dr. Lütken calls attention to the fact that the *Gempylidæ* possess a system of dermal ribs or subcutaneous ribs, composed of slender bony filaments close-set, directed backward and upward, and backward and downward from the median line. This character has been verified in *Thyrsites*, *Nealotus*, and *Gempylus*. (*Trichiuridæ*, part, Günther, Cat., II, 349–353, 1860.)

Thyrsitinæ:

*a.* Body moderately elongate, the dorsal spines less than 30, the finlets usually few.
  *b.* Ventrals well developed, their rays I, 5.
    *c.* Dorsal and anal each with detached finlets.
      *d.* Lateral line well developed, moderately curved; finlets 2; skin with small thin scales. Bipinnula, 396.

*dd.* Lateral line obsolete or nearly so; finlets 2; skin with bony tubercles. RUVETTUS, 397.

*cc.* Dorsal and anal each without finlets; lateral line present, double. EPINNULA, 398.

*bb.* Ventral fins each reduced to a single spine.

*e.* Dorsal fin more or less separated from soft part of the fin; body not greatly elongate; finlets few or none.

*f.* Space between vent and anal fin armed with a dagger-shaped spine; lateral line present, single; 2 or 3 finlets present. NEALOTUS, 399.

*ff.* Space between vent and anal without dagger-shaped spine; finlets 2; lateral line single; ventrals minute; (young without finlets and with the ventral spines very long and jagged). PROMETHICHTHYS, 400.

GEMPYLINÆ:

*aa.* Body greatly elongate, the dorsal fin with about 30 spines, the spinous part continuous with the soft part; dorsal and anal finlets 6; dentition strong; ventrals I, 5, very small. GEMPYLUS, 401.

## 396. BIPINNULA, Jordan & Evermann.

*Bipinnnla*, JORDAN & EVERMANN, new genus, (*violacea*).

Body subfusiform, elongate, low, uniform, slender; head compressed; lower jaw longest, both jaws with small teeth; teeth on vomer fang like. First dorsal low, uniform, of 20 slender spines, the fin near soft dorsal, the anterior lobe of which is moderately developed; finlets 2, anal spines 3, a dagger-shaped spine before it. Ventrals moderate, I, 5; pectorals inserted low. Scales thin, cycloid, deciduous; lateral line single. No gill rakers. One species known. Dr. Gill divides the genus *Thyrsites*, Cuvier & Valenciennes, into *Thyrsites*,* with 6 or 7 finlets, the lateral line abruptly decurved, and *Thyrsitops*,† with 4 or 5 finlets, and the lateral line nearly straight. The American species, *violacea*, with 2 finlets, and the lateral line lightly curved is still better distinguished, and should probably constitute the type of a new genus, for which we propose the name *Bipinnula*. (*bis*, two; *pinnula*, finlet.)

### 1267. BIPINNULA VIOLACEA (Bean).

Head 4; depth 8. D. XX–I, 19+II; A. 17+III; V. I, 5; P. 13. Width of interorbital area slightly greater than length of eye, which is contained nearly 7½ times in length of head and 3½ times in length of upper jaw. Least height of tail equals width of interorbital area. Length of snout twice that of longest dorsal spine, and ½ distance from snout to origin of spinous dorsal. Maxilla extending to vertical through front of eye. Length of upper jaw equals 3¼ times width of interorbital space. Mandible reaches to vertical through hind margin of eye; its length, including the fleshy tip, is 5 times width of interorbital area. Anterior nostril smaller than posterior; situated in advance of eye 1 diameter of eye. Posterior nostril a narrow slit placed midway between anterior and eye. Strong teeth on intermaxillary and mandible. Three large fangs anteriorly in roof of mouth; pseudobranchiæ well developed; no trace of gill rakers. Spinous dorsal begins at a distance from snout which equals twice length of snout; it is highest in middle. Ninth and thirteenth spines slightly longer than third spine and more than twice as long as twentieth, their length equaling ½ that of snout. Soft dorsal highest anteriorly, its longest ray, the fifth, being nearly twice least height of tail. Caudal forked, its middle rays about ½ as long as external rays. Anal origin under the third ray of soft dorsal, its distance from vent 2¼ times length of dagger-shaped spine. Vent directly under end of spinous dorsal. Anal rays longest anteriorly, the fifth ray being nearly as long as corresponding ray of soft dorsal. The dagger-shaped spine in front of anal ½ least height of tail; ventral immediately under third spine of dorsal; its first and longest ray ¾ interorbital width; fifth ray about ⅜ as long as first; pectoral beginning under second dorsal spine, its length 2½ times width of interorbital area, extending to vertical midway between fifth and sixth dorsal spines. Lateral line well developed, descending gradually from upper angle of gill opening, reaching median line of body under soft dorsal. Scales irregular in shape, thin, elongate, cycloid, and deciduous. Purplish; the spinous dorsal, pectorals, ventrals, and inside of mouth blackish. Known from one specimen caught by Captain Thomas Thompson, on Le Have Bank, south of Newfoundland, in 125 fathoms. (Bean.) (*violacea*, violet-colored.)

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* *Thyrsites*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., VIII, 196, 1831, (*atun*). (*Thyrsites*, an old name of some fish, from θύρσος, a wand.)

† *Thyrsitops*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 125, (*lepidopoides*).

*Thyrsitops violaceus*, Bean, Proc. U. S. Nat. Mus., 1887, 513, Le Have Bank. (Type, No. 39287. Coll. W. A. Wilcox); Goode & Bean, Oceanic Ichth., 195, 1895.
*Thyrsites niger*, Poey, Enumeratio, 74, 1875.

## 397. RUVETTUS, Cocco.

(Escolares.)

*Ruvettus*, Cocco, Giorn. Sci. Sicilia., xlii, 2, 1829, (*pretiosus*).
*Aplurus*, Lowe, Trans. Zoöl. Soc. Lond., ii, 180, 1841 (*simplex*).
*Acanthoderma*, Cantraine, Journ. Ac. Sci. Belles-Lettres Bruxelles, x, 1835, (*temminki*).

Body fusiform, moderately elongate, the skin covered with bony tubercles remote from each other and obliquely placed. Mouth large, with strong teeth, some of the anterior in each jaw canine-like. Lateral line obscure, little developed. Abdomen keeled. Tail not keeled. Dorsals near together, well differentiated; dorsal and anal each with 2 finlets. Ventral rays I, 5. Color black. One species. A large, deep-water fish, generally valued as food in the tropics. (*Roveto* or *Ruvetto*, Italian name of *Ruvettus pretiosus*.)

### 1268. RUVETTUS PRETIOSUS, Cocco.

(Escolar; Rovetto; Ruvetto; Chicolar; Oil Fish; Scour Fish; Plain-tail.)*

Head 4; depth 6; eye large, 5. D. XV–18–II; A. 17–II; V. 1, 5; C. 9 + 8; vertebræ 16 + 16 = 32. Cœca 11 to 14. Body oblong, compressed, not greatly

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*Another fish of this group, apparently allied to *Escolar* has been mentioned as *Thyrsites niger*, Poey.

Known only from a fragment of the tail of a specimen weighing about 100 pounds. Caudal peduncle with a distinct keel. Scales thin, smooth, and roundish, not spinous. Color everywhere intense black. Last rays of dorsal apparently detached. Flesh white, exquisite in flavor, as in *Ruvettius pretiosus*. Havana. (Poey.) Thrown on shore by a storm. This is probably not a *Thyrsites*, nor a *Bipinnula*, as the caudal peduncle has no keel in either genus. (*niger*, black.)

elongate. Head large, compact, plain, with flat and even sides, clumsier than in *Promethichthys*, the lower jaw being very strong. Top of head broad and flat. Mouth very large, the gape extending beyond middle of eye; teeth strong, some of the anterior canine-like. First dorsal low, the spines slender; second dorsal and anal high in front. Caudal large, broadly forked. Pectorals small, ventrals smaller. Skin apparently smooth and scurfy in appearance, harsh and stiff to the touch. Skin covered with small, irregular, cycloid scales and also rows of glassy forked prickles in quincunx, the structure of these complicated and peculiar; each one ╳-shaped or ⤫-shaped, with 2 points and 2 or 3 roots. Color purplish brown, darker above and with blackish patches; inside of mouth dusky. Tropical parts of the Atlantic in deep water. Abundant in deep water about Cuba and the Madeiras, frequently taken in the Mediterranean, two specimens, 4 and 6 feet long, taken off the Grand Banks of Newfoundland. Found in 300 to 400 fathoms. It reaches a weight of 100 pounds and is valued as food. "The Cuban fishermen go 'a-scholaring' ('á escolarear'), after the fishing for the spearfish has ceased and before that for the red snapper begins." The flesh is white and flaky, but soft and insipid in the Madeiras, according to Lowe, where its extreme oiliness makes it unwholesome. (*pretiosus*, precious.) (Eu.)

*Ruvettus pretiosus*, Cocco, Giornale di Scienze per la Sicilia, XLII, 21, 1829, Messina.
*Tetragonurus simplex*, Lowe, Proc. Zoöl. Soc. Lond., 143, 1833, Madeira,
*Rovetus temminkii*, Cantraine, Giorn. Sci. et Litt. Pisa, 1833, Malta; fide Poey.
*Thyrsites acanthoderma*, Lowe, Proc. Zoöl. Soc. Lond., 1839, 78, Madeira.
*Thyrsites scholaris*, Poey, Memorias, I, 372, 1851, pl. 32, fig. 1, Havana.
*Thyrsites pretiosus*, Günther, Cat., 351, 1860.
*Aplurus simplex*, Lowe, Trans. Zoöl. Soc. Lond., II, 1841, 180.
*Rovettus temminkii*, Valenciennes, in Webb & Berthelot, Poiss. Canar., 52, plates.
*Acanthoderma temminkii*, Cantraine, Journ. Ac. Sci. et Belles-Lettres, Bruxelles, 1835, X, pl. 1.

## 398. EPINNULA, Poey

*Epinnula*, Poey, Memorias, I, 369, 1854, (*magistralis*).

Body fusiform, somewhat compressed, moderately elongate, covered with minute thin scales. Lateral line present, double. Dorsal fins contiguous, barely connected, the spines well differentiated. Ventrals I, 5. No finlets. Tail not keeled. Deep waters of the Atlantic. (Name shortened from *epinnulatus*, without finlets.)

### 1269. EPINNULA MAGISTRALIS, Poey.

(Dómine.)

Head 3; depth 5. D. XV–I, 16; A. III, 13; V. I, 5; P. 15; C. 8+7; B. 7; cœca 10. Body moderately elongate, compressed. Maxillary reaching middle of eye; eye large, about 2 in snout; opercular point soft; first dorsal low, depressible in a groove; anal beginning but little behind second dorsal. Caudal forked, the lower lobe shorter; pectorals not falcate; ventrals half smaller, under lower angle of pectoral. Intestinal canal straight. Head about as in *Ruvettus*, the mouth large; the maxillary nearly half head; lower jaw projecting; premaxillaries bordered with an external series of sharp teeth; about 2 large compressed canines on each side in front; one on each side near tip of low jaw; lower teeth otherwise smaller. Scales small, caducous. Upper lateral line very high, parallel with back; lower joining it behind the shoulder, thence curving downward, following outline of belly. Intestinal canal short. Bluish, darker above, silvery below. (Poey.) Two specimens known, one taken near Havana in 1853, 3 feet long, the other obtained by the *Albatross* in 1885. (*Magistralis*, master; in Spanish, *Dómine*; in reference to its resemblance to the scholar, *Escolar*, *Ruvettus pretiosus*.)

*Epinnula magistralis*, POEY, Memorias, I, 369, 1851, Havana; GÜNTHER, Cat., II, 349, 1860; GOODE & BEAN, Oceanic Ichthyol., 198, 1895.

## 399. NEALOTUS, Johnson.

*Nealotus*, JOHNSON, Proc. Zoöl. Soc. Lond., 1865, 434, (*tripes*).

Body elongate, much compressed, incompletely covered with delicate scales. Cleft of mouth deep. Small teeth in jaws and on palatine bones; none on vomer. First dorsal (composed of about 20 spines) continuous, extending to the second; finlets behind dorsal and anal; a dagger-shaped spine behind vent. No keel on tail. Caudal fin well developed. Ventrals reduced to a spine each. Seven branchiostegals. Deep seas; one species known. (*νεάλωτος*, newly caught.)

### 1270. NEALOTUS TRIPES, Johnson.

Head 4½; depth 9½; eye 5; snout 3. D. XXI, 19 + II; A. 18, III; P. 13; V. 1. Body very elongate, with a few large, deciduous, simple scales of delicate structure here and there upon its surface. Head flattened above, concave in interorbital region, with 4 low ridges, the inner pair of which inclose an elongate, diamond-shaped space; lower jaw longest. Eye round, lateral; opercle with 2 obtuse projections behind, separated by a notch. Spinous dorsal inserted in front of root of pectoral, its height slightly greater than half that of body; its length less than half that of body, placed in a groove; the second dorsal placed close behind first, not so high and less than half as long. Pectoral origin under angle of opercle, its length equal to that of second dorsal fin. Spines representing ventrals inserted close together under hinder part of roots of pectorals, their length about ¼ height of body. These spines are longitudinally grooved, and each appears to consist of 2 or 3 spines coalesced together. Vent very slightly postmedian; a flat, dagger-shaped spine, longitudinally grooved, half as long as height of body, inserted close behind vent. Anal fin inserted behind this spine at a distance about equal to its length, and opposite to, but rather shorter than second dorsal. Caudal fin deeply furcate. Lateral line descends obliquely from above opercle to middle of length of fish, and then continues with a gentler obliquity along posterior part of body to tail, where it is inserted at ⅓ distance from ventral to dorsal outline. (Goode & Bean.) Two specimens known, one from Madeira, the other taken by the *Challenger* between the Bahamas and Bermudas. (*tripes*, 3-footed, the 2 ventral spines and the anal spine forming a tripod.)

*Nealotus tripes*, JOHNSON, Proc. Zoöl. Soc. Lond., 1865, 434, Madeira.

## 400. PROMETHICHTHYS, Gill.

(CONEJOS.)

*Prometheus*, QUOY & GAIMARD, MS.
*Prometheus*, LOWE, Trans. Zoöl. Soc. London, II, 181, 1841, (*atlanticus*); name preoccupied.
? *Dicrotus*,* GÜNTHER, Cat., II, 349, 1860, (*armatus*).
*Promethichthys*, GILL, Mem. Nat. Ac. Sci., VI, 115, 123, 1893, (*atlanticus*; substitute for *Prometheus* of LOWE).

Body elongate, slender, fusiform; mouth large, with two strong canines in front of each jaw; spinous dorsal long, contiguous to the soft, which is rather high; two finlets above and two below; pectorals comparatively low; caudal without keel; ventrals represented by a pair of minute spines; no dagger-shaped spine behind vent. Preoperculum unarmed except in young. Lateral line descending in an oblique line, undulating below the front of the spinous dorsal. Scales very minute, smooth. Voracious fishes of the open seas, reaching a moderate size. (προμηθης, wary; ἰχϑύς, fish.)

*a.* Head short, 4 in length; depth 7. PROMETHEUS, 1271.
*aa.* Head longer, 2⅓ in length; depth 6. PARVIPINNIS, 1272.

### 1271. PROMETHICHTHYS PROMETHEUS, Cuvier & Valenciennes.

(RABBIT FISH; COELHO; CONEJO; BERMUDA CATFISH.)

Head 4; depth 7. D. XVIII–19 or 20–II; A. 16–II; V. I; vertebræ 30 + 14 = 44. Body elongate, compressed throughout, nowhere carinate. Head smooth; eyes prominent, the space between them flat, with a shallow median groove. Mouth large, the gape about reaching middle of eye. Both jaws with an outer row of about 25 short, strong, compressed triangular teeth; anterior canines similar but much stronger; vomer toothless; palatines with fine close-set teeth. First dorsal low, its spines weak, with fragile membrane; second dorsal high; caudal forked. Ventrals reduced to two small blunt scale-like spines, much larger in the young, where minute rays are also present. Lateral line abruptly bent downward under front of dorsal, without dorsal branch. Scales minute, apparently wanting; vertical fins with rudimentary scales. Uniform deep coppery brown in life, with metallic iridescence, with some blackish cloudings; fins more or less dusky. Tropical islands of the Atlantic, in deep water; west to Cuba and the Bermudas; not very common. (Lowe.)

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[*] The generic name, *Dicrotus*, was given to a very young fish, *Dicrotus armatus*, GÜNTHER, from unknown locality. The characters of *Dicrotus* are those of larval *Gempylinæ* and *Thyrsitinæ*. In these larvæ the ventral spines are elongate, the preopercle armed with spines, the finlets connected with the body of the fin, the anal spines more developed, and the body short. Lütken regards *Dicrotus armatus* as the young of *Promethichthys prometheus*, in which case the name *Dicrotus* (δίκροτος, two-oared), would supersede *Promethichthys*. The description of *Dicrotus*, however, applies better to *Promethichthys promethoides* (Bleeker), an East Indian species having D. XVIII–II, 15–II, A. II, 14, II, and two lateral lines. This species apparently belongs to a different genus from *Promethichthys prometheus*. For this latter genus, the name *Dicrotus* should be retained.

The following is the generic description of *Dicrotus*: "Body rather elongate, compressed; cleft of mouth wide. First dorsal continuous, with the spines of moderate strength, and extending on to the second; finlets none. Ventral reduced to a long, crenulated spine. Preoperculum with several spines at the angle. Body naked. Several strong canines in the jaws; minute teeth on vomer and palatine bones. No keel on tail. Seven branchiostegals. Pseudobranchiæ present. (Günther.) Fin rays D. XVIII, 18; A. II, 16; V. I, in *Dicrotus armatus*.

"This fish, the 'Coelho' or Rabbit Fish of Madeira, lives habitually at the bottom, and is taken at most seasons at a depth of from 100 to 300 or 400 fathoms, and in the summer months, according to Lowe, it is generally one of the commonest and cheapest fishes in the market, where it is sold in bundles, chiefly to the Portuguese. It breeds in August and September, and attains a length of 1½ to 2½ feet. It is a very wary fish, its name of rabbit fish being due to its habit of snapping off bait. Several specimens were obtained in Bermuda in 1877 by Dr. Goode. The fishermen obtain it at a depth of 60 to 100 fathoms, and it is known to them as the 'Catfish.'" (Goode & Bean.) (*Prometheus*, a classical name "*par une allusion facile à saisir.*")

*Gempylus prometheus*, Cuvier & Valenciennes, Hist. Nat. Poiss., viii, 213, pl. 222, 1831, St. Helena.

*Gempylus solandri*, Cuvier & Valenciennes, *l. c.*, viii, 215, 1831, New Holland; after Solander MS.

*Gempylus prometheus*, Valenciennes, Ichth. Iles Canaries, 51, pl. 11.

*Prometheus atlanticus*, Lowe, Trans. Zoöl. Soc. London, 11, 181, 1841, Madeira.

*Promethichthys atlanticus*, Goode & Bean, Ocean. Ichth., 200, 1895.

We provisionally associate with *Promethichthys*, the fish called *Dicrotus parvipinnis* by Goode & Bean, the very young or larva of some unknown species. If the small number of dorsal and anal rays is permanent, this species would form a new genus, between *Promethichthys* and *Gempylus*, the small soft dorsal and anal marking a transition toward the *Lepidopidæ*.

### 1272. PROMETHICHTHYS PARVIPINNIS (Goode & Bean).

Head 2⅛; depth 6; eye 6; height of tail 2 in eye. D. XXI, 11; A. II, 8; P. 12; V. I, 1, or I, 2. Upper jaw reaching vertical from front of orbit. Three large fangs in upper jaw, a large fang near tip of lower jaw, and 8 smaller teeth. Three weak, diverging spines on the border of preoperculum. Dorsal originating at a distance behind eye about equal to 1½ times length of eye, or about over middle of operculum; spines all serrated, the first 5 about equal; they diminish gradually in size from fifth, and the last is only about ½ as long as eye. The ventral origin is under the sixth dorsal spine; the spine strongly serrated, its length equal to that of ninth dorsal spine; ventral with either a single bifid ray or 2 simple rays. Color silvery; caudal peduncle and top of back at base of dorsal brownish. Western Atlantic; *Albatross* stations 2537, 2542, and 2601; about 40° N., 70° W.; known only from larval specimens. (*parvus*, small; *pinna*, fin.)

*Dicrotus parvipinnis*, Goode & Bean, Oceanic Ichthyology, 201, 1895, Gulf Stream.

## 401. GEMPYLUS, Cuvier & Valenciennes.

(Snake Mackerels.)

*Gempylus*, Cuvier & Valenciennes, Hist. Nat. Poiss., viii, 207, 1831, (*serpens*).

*Lemnisoma*, Lesson, Voyage Coquille, Poissons, 160, 1826, (*thyrsitoides*).

*Zyphothyca*, Swainson, Nat. Hist. Fishes, ii, 1839, 239, (*coluber*).

Body very much elongate, compressed, and band-shaped, approaching the form of *Lepidopus*. Head long, pointed anteriorly, the lower jaw projecting, the anterior teeth in upper jaw very long, canine-like. Scales minute or obsolete. Spinous dorsal very long, of about 30 spines; soft dorsal low, but with a distinct lobe, similar to anal and both followed by 5 to 7 finlets. Ventrals I, 5, but extremely minute. Caudal fin rather small, well forked. Lateral line single, arched anteriorly. Vertebræ 28 + 25 = 53. Air bladder present. Young having the "*Dicrotus*" form, with large head, spinous ventrals, and spinigerous preopercle. Deep sea. (*Gempylus*, an old name of some Scombroid fish.)

### 1273. GEMPYLUS SERPENS, Cuvier & Valenciennes.

Head 5¼; depth 17. D. XXX–I, 13–V; A. II–I, 11–VII; V. I, 5; vertebræ 28 + 25 = 53. Eye 7 in head. Maxillary nearly reaching front of pupil. Each jaw with a series of compressed, triangular, trenchant teeth; about 6 long canines in front of jaws, some of these with an emargination, as in *Sphyræna*; palatines with a row of small teeth, none on vomer; usually a single canine at tip of lower jaw. Lateral line straight except anteriorly. Dorsal spines slender; soft dorsal and anal small, with numerous finlets. Pectorals pointed, rather long; ventrals minute. Color dark metallic blue. Flesh firm. Deep seas; a rare fish, widely distributed, reaching a length of 3 feet or more. (*serpens*, a snake.)

*Gempylus serpens*, Cuvier & Valenciennes, Hist. Nat. Poiss., viii, 207, 1831, **Martinique.**
*Gempylus serpens*, Günther, Cat., ii, 350, 1860.
*Gempylus coluber*, Cuvier & Valenciennes, *l. c.*, 211, **Otaiti.**
*Gempylus ophidianus*, Poey, Memorias, ii, 246, 1861, **Cuba.**
*Lemnisoma thyrsitoides*, Lesson, Voyage Coquille, 160, 1826.
*Gempylus serpens*, Goode & Bean, Oceanic Ichth., 202, 1895.

## Family CXX. LEPIDOPIDÆ.

Body elongate, band-shaped, scaleless; dorsal long, continuous or subcontinuous, without distinct lobe to the soft dorsal; anal comparatively short, preceded by a considerable number of short detached spines; no finlets; caudal small, but distinct and forked; pectorals with some of the lower rays longest; ventrals rudimentary or absent; a spine or scute, or pair of scutes behind the vent. Lateral line conspicuous. Mouth large, the lower jaw projecting. Teeth very strong, premaxillaries not protractile, lanceolate in jaws, more or less larger in front; no teeth in palatines. Air bladder present. Gill membranes separate, free from the isthmus; gills 4, with a slit behind the fourth. Abdominal and caudal vertebræ numerous, 100 or more. Pyloric cœca in large numbers. Three genera, and about 5 species; similar to the *Trichiuridæ* in habit, but retaining the caudal fin of the *Gempylidæ*. This group represents successive steps by which the muscular and free-swimming mackerels become transformed to band-shaped pelagic surface fishes with many vertebræ. The fins and tail become degenerate, the teeth more and more highly specialized. The retention of the rudimentary caudal furnishes a slender character for the distinction of *Lepidopidæ* as a family from *Trichiuridæ*. (*Lepidopodidæ*, Gill, Standard Natural History, iii, 206, 1885.)

APHANOPINÆ:

*a.* Dorsal divided into two portions; front of anal with a dagger-shaped spine behind vent; ventrals wanting; vertebræ 43 + 57 = 100. APHANOPUS, 402.

LEPIDOPINÆ:

*aa.* Dorsal fin continuous; front of anal without dagger-shaped spine; ventrals reduced to a pair of scales; body not very slender; head with a crest above.
  *b.* Dorsal rays less than 100; two distinct postanal scutes; ventrals behind base of pectorals.
    *c.* Head short, high, compressed above to a trenchant edge; jaws equal; profile convex. EVOXYMETOPON, 403.
    *cc.* Head rather long, with lateral occipital crests converging anteriorly; lower jaw projecting. LEPIDOPUS, 404.
  *bb.* Body low; head without crest; dorsal rays about 150; one postanal scute; ventrals below base of pectorals. BENTHODESMUS, 405.

## 402. APHANOPUS, Lowe.

*Aphanopus*, LOWE, Proc. Zoöl. Soc. Lond., 1839, 79, (*carbo*).

Body very elongate, band-like, scaleless; head long, pointed; cleft of mouth very wide; jaws armed with strong, lanceolate teeth arranged in single series and in common alveolar groove; no teeth on palatine; eye very large; back occupied by a long dorsal fin, divided in two subequal parts; anal spines numerous and feeble; a dagger-shaped spine behind vent; caudal well developed, deeply cleft; pectorals moderate, rounded; ventrals absent; branchiostegals 7; air bladder present. Pyloric appendages few. Two species in the deep sea. (ἀφανής, invisible; ποῦς, foot.)

### 1274. APHANOPUS MINOR, Collett.

Head about 2⅗ in length of body to vent; eye about 4⅘ in head. D. XLI, X + ?; B. 11. Eight long teeth in the intermaxillary, the two foremost "canines" the longest; 8 teeth in the lower jaw, a trifle shorter; no teeth in vomer and the palatine bones. Ventrals none; a strong dagger-shaped spine behind vent. Air bladder present; pyloric cœca 7. Dark silvery or steel-colored. Length from tip of snout to vent (in the single specimen examined) 352 millimeters. One specimen known, from the east coast of Greenland, 65° N., 31′ W. (Collett.) (*minor*, smaller.)

*Aphanopus minor*, COLLETT, Vidensk. Selsk. Forhandl. Christiania, No. 19, 3, 1886, east coast of Greenland; GOODE & BEAN, Oceanic Ichthyology, 207, 1895.

## 403. EVOXYMETOPON, Poey.

(TIRANTES.)

*Evoxymetopon* (POEY) GILL, Proc. Ac. Nat. Sci. Phila., 1863, 228, (*tæniatus*).

Body very elongate, band-like; head with the supraocular portion compressed into a trenchant edge, and the upper profile abruptly descending toward the end of the snout; eye of moderate size, much below upper profile. Cleft of mouth wide; teeth lanceolate, in single rows, with larger ones in front; a series of small teeth on palatines. Fins as in *Lepidopus*. One species. (εὐ, true; ὀξύς, sharp; μέτωπον, forehead.)

### 1275. EVOXYMETOPON TÆNIATUS, Poey.

(Tirante; Tyrant Fish.)

Head 8 in extreme length; depth 12; eye about 6 in head. B. 7; D. 87; A. 19; C. 17; P. 12. Head oblong, trenchant above, elevated above eyes for a space considerably greater than diameter of eye, and decurved very obliquely downward to snout. The first 10 dorsal spines undivided; the rest split. Color silvery, with about 6 narrow reddish bands, most distinct behind, the first on the ridge of the back and the fifth along lateral line. Cuba, in deep water; rare. Size small. (Poey.) According to Drs. Gill and Günther a specimen probably identical with this was recorded early in the present century from Scotland by Hoy. (*tæniatus*, with ribbon-like stripes.)

*Evoxymetopon tæniatus* (Poey) Gill, Proc. Ac. Nat. Sci. Phila., 1863, 228, Cuba; Gill, Proc. Ac. Nat. Sci. Phila., 1864, 206; Goode & Bean, Oceanic Ichth., 204, 1895.

## 404. LEPIDOPUS, Gouan.

(Frost-fishes.)

*Lepidopus*, Gouan, Hist. Nat. Poiss., 185, 1770, (*gouani*).
*Vandellius*, Shaw, Genl. Zoöl., IV, 199, 1803, (*lusitanicus*).
*Sarcina*, Rafinesque, Car. Nuo. Gen. Sic., 20, 1810, (*argyrea*).
*Ziphotheca*, Montagu, Werner Mem., I, 82, 1811, (*tetradens*).

Body very elongate, band-like, scaleless; head pointed, with lateral occipital crests converging anteriorly; cleft of mouth wide, the jaws being armed with strong lanceolate teeth in a single series, larger ones in front; a series of minute teeth on the margin of the palatines. Nodules oblique. Eyes large. Along the whole of back one single dorsal fin; anal spines numerous, but minute or hidden beneath the skin; no postanal spines; caudal well developed; ventral fins rudimentary, inserted behind pectorals. Two postanal scutes. Eight branchiostegals; air bladder present. Pyloric cœca somewhat numerous. Surface fishes of the open sea, readily chilled by cold weather, hence the name frostfish. (λεπίς, scale; πούς, foot.)

### 1276. LEPIDOPUS CAUDATUS (Euphrasen).

(Frostfish; Scabbard Fish.)

Depth 15½; D. 102 to 104; A. 24 or 25. Cœca 23; vertebræ 41 + 71 = 112. Body very elongate, band-like; cleft of mouth wide. One single dorsal fin extending whole length of the back; caudal well developed; ventrals reduced to a pair of scales; anal spines numerous, but minute or hidden beneath the skin; no scales. Several strong teeth in jaws; teeth on palatines. No keel on tail; 8 branchiostegals; air bladder present; pyloric appendages in increased number. Pelagic, occasional in the Atlantic, from Norway to South Africa and New Zealand. In New Zealand it comes to the surface periodically in great numbers to deposit its spawn. Length 5 or 6 feet. A specimen taken by John Xantus at Cape San Lucas; not otherwise known from American waters. (*caudatus*, tailed.) (Eu.)

*Trichiurus caudatus*, EUPHRASEN, Stockh. K. Vet. Ac. Nya Handl., 52, pl. 9, fig. 2, 1788.
*Lepidopus gouani*, BLOCH & SCHNEIDER, Syst. Ichth., 239, 1801.
*Trichiurus gladius*, HOLTEN, Kiöbenh. Skri. v, Nat. Selsk., v, 23, 1802.
*Trichiurus ensiformis*, VANDELLI, Ac. Sci. Lisb., 1797, Lisbon.
*Vandellius lusitanicus*, SHAW, Gen. Zoöl., IV, 199, 1803, Portugal.
*Lepidopus peronii*, RISSO, Ichth. Nice, 148, pl. 5, 1810, Nice.
*Zipotheca tetradens*, MONTAGU, Wern. Mem., I, 82, pl. 2 and 3, 1811, Great Britain.
*Lepidopus argyreus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., VIII, 223, 1831, France.
*Lepidopus caudatus*, GÜNTHER, Cat., II, 344, 1860; GOODE & BEAN, Oceanic Ichth., 203, 1895.

## 405. BENTHODESMUS, Goode & Bean.

*Benthodesmus*, GOODE & BEAN, Proc. U. S. Nat. Mus., IV, 1881, 380, (*elongatus*).

Body naked, much compressed, attenuate, tapering gradually from vent to base of caudal; caudal peduncle very slender, supporting a small but well-developed caudal fin; vent considerably nearer head than to tail. Lateral line simple, in a deep, wide furrow, nearly straight, in front of the vent gradually ascending to the scapular region. Head compressed, its upper profile nearly horizontal; snout gibbous near its end, as in *Lepidopus*. Top of head very flat, concave between the eyes, with no occipital crest; interorbital ridges not elevated. Eyes large, slightly postmedian. Operculum oblong, reaching a little beyond the base of the pectoral fin. Nostrils horizontal, in front of the eyes. Supramaxillary not extending to vertical from front of eyes; lower jaw with stout cutaneous appendage. Three very long, simple, compressed teeth on each intermaxillary in front; outside of these a few minute teeth, and behind them a row of large acicular teeth; lower jaw with a single row of moderately large acicular teeth, more numerous than in the upper jaw, largest in the middle of the jaw; palatine teeth minute. Dorsal fin beginning above the operculum, nearly uniform in height throughout its entire length, and continuous almost to the caudal; rays very numerous, 150 or more. Anal beginning near the vent, preceded by a single scale-like appendage; spines very numerous (numbering with the rays about 100) all except about 30 being spines, minute and almost hidden; a short fin posteriorly; caudal small, normal, forked; pectoral inserted almost horizontally, with lower rays longest, and its upper outline rounded; ventral fins represented each by a minute scale-like spine, inserted below the origin of the pectorals. Pseudobranchiæ present; gills 4, a slit behind the fourth; gill rakers short and spiny, in a single series on the first and second arches, almost obsolete on the third and fourth. Deep-sea fishes; two species known. (*βένθος*, deep; *δεσμός*, band.)

### 1277. BENTHODESMUS ATLANTICUS, Goode & Bean.

Head 7½, its greatest width 6 in length; depth about 4; snout 2½. D. 154; A. 100; P. 12; V. I, 1. Body attenuate, its height at vent 4 in head, its width ⅓ of its height at the point mentioned; length of caudal peduncle half of greatest height of body; least height of tail ⅓ width of interorbital area; width of interorbital area (on the bone) 4 in head. Upper jaw not reaching vertical from anterior margin of eye, and equaling postorbital portion of head; lower jaw about twice greatest height of body; mandibular tip nearly 3 in eye. Eye slightly postmedian, the orbital diameter equaling half length of snout. Besides the 3 long teeth, there are on each intermaxillary 8 or 9 of moderate size; on one side many small intermediate teeth are present; the number of teeth in the lower jaw varying from 13 on the one side to 21 on the other. Gill rakers 13, the longest about 2 millimeters; about the same number on second arch, while on the third there are but 6 or 7 very small ones, and present only in the angles, while in the fourth there is about the same number, very inconspicuous. Origin of dorsal above middle of opercle, and at a distance from the snout equaling twice length of snout; anal fin composed of about 100 spines and rays. Owing to the mutilation of the specimen it is impossible to determine how many there are of each, but there are supposed to be about 28 rays, normally united by a membrane into a fin. Caudal also imperfect but the middle rays are seen to be about half as long as the remnants of the external rays; the fin supposed to resemble in shape that of *Lepidopus caudatus*; pectoral originating under tip of opercular flap, its outline rounded above instead of emarginate, as in *Lepidopus caudatus*; its longest ray equaling postorbital part of head; ventrals originating at a distance from the snout equaling that of base of pectorals from same point, rudimentary, and represented by minute scutes, the length of which is 3½ millimeters, or about half interorbital width. Cœcal appendages 8 in the specimen examined; some, however, may have been lost, the abdominal viscera having been partly digested by the halibut in the stomach of which it was found. Color uniform silvery, with traces of dark color upon head and tail. Length 35½ inches. One specimen taken from the stomach of a halibut caught on the western edge of the Grand Bank of Newfoundland in 80 fathoms. (Goode & Bean.) (*atlanticus*, Atlantic.)

*Benthodesmus elongatus*, GOODE & BEAN, Proc. U. S. Nat. Mus., IV, 1881, 380–3; not of CLARKE, the original *elongatus* being from New Zealand; JORDAN & GILBERT, Synopsis, 910, 1883.
*Benthodesmus atlanticus*, GOODE & BEAN, Oceanic Ichth., 205, 1895, Grand Bank.

## Family CXXI. TRICHIURIDÆ.

### (THE CUTLASS FISHES.)

Body extremely elongate, band-shaped, naked, tapering to a point, the ventral fins imperfect or wanting and the spinous and soft parts of the dorsal fin not differentiated. Mouth wide, the jaws armed with strong unequal teeth. Premaxillaries not protractile. Pseudobranchiæ present. Gills 4, a slit behind the fourth; gill membranes separate, free from the isthmus; lateral line present; dorsal fin very long, low, usually continuous, the rays all similar. Caudal fin absent; anal fin very long and low, scarcely rising above the surface of the skin. Ventrals thoracic, rudimentary (*Eupleurogrammus*) or wanting. Vertebræ in greatly increased number, about 160. Air bladder present. Pyloric cœca numerous. Genera 2, species about 6. Surface fishes of the tropical seas. Very close to the *Lepidopidæ* and *Gempylidæ*, differing from the former chiefly in the absence of the caudal fin, the last stage in the progressive reduction of parts seen in these groups. (*Trichiuridæ*, part, Günther, Cat. Fishes, 346.)

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| *a.* Ventral fins wanting. | TRICHIURUS, 406. |

## 406. TRICHIURUS, Linnæus.

(HAIRTAILS.)

*Trichiurus*, LINNÆUS, Syst. Nat., Ed. x, 246, 1758, (*lepturus*).
*Gymnogaster*, GRONOW, Mus. Ichth., I, 17, No. 47, 1754, and Zooph., I, 136, 1763, (*lepturus*).
*Enchelyopus* (KLEIN) BLEEKER, Mém Poiss. Guin., 9, 73, 1862, (*lepturus*).
*Lepturus* (ARTEDI) GILL, Proc. Ac. Nat. Sci. Phila., 1862, 126, (*argenteus*).

Body extremely elongate, band-like, the tail very slender, tapering to a fine point, without caudal fin. Head long, with a very wide mouth, the jaws armed with unequal and very strong teeth; upper jaw with about 4 long, strongly compressed barbed teeth; teeth on the palatines, none on the vomer. Lower jaw longest, preorbital covering cleft of mouth posteriorly. Dorsal fin single, low, occupying the whole of the back, the spines not distinguishable from the soft rays; anal very long, its base more than half the length of the body; composed of detached spines, which are very short, nearly hidden in the skin, the anterior directed backward, the posterior forward; ventral fins wanting; pectorals small. No scales. Lateral line decurved, concurrent with the belly. Vertebræ 39 + 120, ribs excessively frail. Color silvery. Voracious fishes of the high seas; reaching a considerable size. (*τριχίον*, a little hair; *οὐρά*, tail.)

### 1278. TRICHIURUS LEPTURUS, Linnæus.

(CUTLASS FISH; SCABBARD FISH; SILVERFISH; SABLE; SAVOLA.)

Head about 7½; depth about 16; eye 2 in snout. D. 135; A. about 100; snout long and pointed, about as long as pectoral; maxillary reaching nearly to pupil, concealed by preorbital. Uniform bright silvery; dorsal dark-edged. Warm seas, chiefly of the western Atlantic, north to Virginia; occasionally in Lower California (Streets); common in the West Indies, swimming near the surface, where it becomes benumbed with the slightest cold.* (*λεπτος*, slender; *οὐρά*, tail.)

*Trichiurus lepturus*, LINNÆUS, Syst. Nat., Ed. x, 246, 1758, America; after *Lepturus* of ARTEDI; CUVIER & VALENCIENNES, Hist. Nat. Poiss., VIII, 237, 1831; GÜNTHER, Cat., II, 346, 1860; STREETS, Bull. U. S. Nat. Mus., VII, 46, 1877; JORDAN & GILBERT, Synopsis, 422, 1883.
*Trichiurus argenteus*, SHAW, Gen. Zoöl., IV, 90, pl. 12, 1803, after Linnæus.
*Lepturus lepturus*, POEY, Enumeratio, 94, 1860.

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*"A commercial fishery of considerable importance exists at Jamaica. This species enters the estuary of St. John's River, in Florida, and has been known to leap into rowboats. Linnæus wrote of it in 1758: 'Totus argenteus exiliens ex aqua sæpe in cymbam.'" (Syst. Nat., Ed. x, I, 246.) (Goode.)

## Family CXXII. ISTIOPHORIDÆ.*

(THE SAILFISHES.)

Body elongate, much compressed, covered with elongate scutes; bones of upper jaw consolidated into a sword, which is roundish on the edges and spear-like, shorter than in *Xiphias*. Jaws with small, persistent granular teeth. Ventral fins of 1 or 2 rays each, attached to a pelvic arch; dorsal single, or divided into 2 contiguous portions, the first much longer than the second, the fin rays distinct, the first rays of dorsal distinctly spinous; anal divided, last rays of dorsal and anal suctorial; caudal peduncle with 2 fleshy crests or keels. Vertebræ $12+12=24$, elongate, hourglass-shaped; neural and hæmal spines flag-like; ribs well developed. Air bladder very large, sacculate, of numerous separate divisions. Intestine short, straight. Gills reticulated as in *Xiphias*. Two genera, with about 5 species, oceanic, similar in character and habits to the swordfishes, but smaller in size. This group represents a younger stage in the development of *Xiphias*, and is intermediate between the latter and the Scombroid stock, from which both are derived. The gaps are wide in the series *Scomberomorus*, *Acanthocybium*, *Istiophorus*, *Tetrapturus*, *Xiphias*, but the natural sequence seems evident. Several fossil genera of sailfishes are recorded. Other forms are apparently intermediate between them and the mackerels.

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|---|---|
| *a.* Ventral rays 2 or 3; dorsal very high, undivided. | ISTIOPHORUS, 407. |
| *aa.* Ventral rays united into 1; dorsal low, divided in the adult. | TETRAPTURUS, 408 |

### 407. ISTIOPHORUS, Lacépède.

(SAILFISHES.)

*Istiophorus*, LACÉPÈDE, Hist. Nat. Poiss., III, 374, 1802, (*gladifer* = *gladius*).
*Histiophorus*, CUVIER & VALENCIENNES; amended spelling.
*Makaira*, LACÉPÈDE, Hist. Nat. Poiss., IV, 688, 1803, (*nigricans*).
*Machæra*, CUVIER; amended spelling.
*Macaria*, NARDO, Isis, XXVI, Col. 418, 1833; amended spelling.
*Notistium*, HERMANN, Observ. Zoöl., 305, 1804, (*gladius*).
*Zanclurus*, SWAINSON, Nat. Hist. Fish., II, 239, 1839, (*indicus* = *gladius*).

Body slender, much compressed, covered with elongate scales. Numerous small teeth on the jaws and palatines. Ventral fins present, of 2 or 3 rays; dorsal fin extremely high, continuous, as in the young of *Tetrapturus* and *Xiphias*; the rays very numerous, none being aborted, the height of the first much greater than that of body; anal fin divided. Air bladder sacculate; intestine short, nearly straight. Sword usually shorter and less flattened than in *Xiphias*, the edge more rounded, the lower jaw more developed. The skin is also rougher. Large fishes of the warm seas; the number of species uncertain, probably several. (*ἱστίον*, sail; *φορέω*, to bear.)

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* For a detailed account of the *Istiophoridæ* and *Xiphiidæ* see Goode, Proc. U. S. Nat. Mus., 1881, 415.

### 1279. ISTIOPHORUS NIGRICANS (Lacépède).

(SAILFISH; SPIKEFISH; BOOHOO; GUEBUCU; VOILIER; AGUJA VOLADORA; AGUJA PRIETA.)

Head 2⅔ (3¼ in length with caudal); depth about 6. D. XLI-7; A. 9-7. Longest dorsal spine ¾ total length of head. Ventrals 1⅚ in head; pectorals 3⅖; caudal lobes 1⅞. Snout, from eye, 2½ times length rest of head; lower jaw 3½ in head. Front of eye nearly midway between tip of lower jaw and edge of opercle. Interorbital space broad, flattish, 1⅗ in postorbital part of head. Maxillary reaching to slightly beyond eye, which is 2⅓ in postorbital part of head and 10 in snout. Sword narrow, regularly tapering, depressed, its upper and lower surfaces both rounded, its edges blunt and rougher than its upper side. For its entire length it is nearly twice as broad as deep. Breadth of snout at the middle point between its tip and the eye 25 times in its length from the eye. Bluish black, paler below; dorsal dusky bluish; its membranes with many nearly round black spots, from ⅓ to ¼ diameter of orbit. Length of specimen described (obtained by Dr. Jordan at Key West) 6 feet. West Indies and warmer parts of the Atlantic, north to Key West and France; rather common about the Florida Keys; stragglers taken at Newport and Savannah; very rare in Europe. Differing from the East Indian *Istiophorus gladius* in the longer and slenderer sword and in the shorter dorsal fin. (Eu.)

*Makaira nigricans*, LACÉDÈDE, Hist. Nat. Poiss., IV, 688, 1803, Rochelle; from a drawing by M. TRAVERSAY.

*Xiphias makaira*, SHAW, Gen'l. Zoöl., IV, 104, 1803, Rochelle; after LACÉPÈDE.

*Histiophorus americanus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., VIII, 303, 1831, Brazil; after Guebucu of MARCGRAVE.

?*Histiophorus pulchellus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., VIII, 305, 1831, Eastern Atlantic, north of Cape of Good Hope.

*Skeponopodus guebucu*, NARDO, Isis., XXVI, Col. 416, 1833, Brazil; after MARCGRAVE.

## 408. TETRAPTURUS, Rafinesque.

(SPEARFISHES.)

*Tetrapturus*, RAFINESQUE, Indice d'Ittiol. Sicil., 30, 1810, (*belone*).

*Skeponopodus*, NARDO, Isis., XXVI, Cols. 416, 419, 1833, (*typus*).

Body much compressed, covered with rudimentary embedded scales; sword rounded on the edge; caudal keel double; small teeth in the jaws and on the palatines; ventral fins represented each by a single spine; dorsal fins separate in the adult, part of the middle rays being aborted, not greatly elevated, their height not greater than the depth of the body. Air bladder sacculated. Vertebræ 12 + 12. Intestine short, nearly straight. Pyloric cœca very numerous. Large fishes of the deep seas. They swim in deep water, according to Poey, and pass Cuba in pairs in summer bound for the Gulf of Mexico. Males smaller than females. (*τετρα-*, four; *πτερόν*, wing; *οὐρά*, tail, from the wing-like caudal keels.)

*a.* Body rather slender, the height of dorsal in adult more than half depth of body; caudal moderately forked. IMPERATOR, 1280.

*aa.* Body robust, the height of dorsal barely half depth in adult; caudal very widely forked. AMPLUS, 1281.

### 1280. TETRAPTURUS* IMPERATOR (Bloch & Schneider).

*Tetrapturus indicus*, Cuvier & Valenciennes, Hist. Nat. Poiss., VIII, 286, 1831, Sumatra; on a figure by Banks.
*Tetrapturus herschelii*, Gray, Ann. Nat. Hist., I, 313, 1838, Table Bay, Cape of Good Hope.
*Histiophorus herschelii*, Günther, Cat., II, 513, 1860.
*Histiophorus brevirostris*, Günther & Playfair, Fish. Zanzibar, 53, 1866, Zanzibar.
*Tetrapturus herschelii*, Lütken, Spolia Atlantica, 441, 1890.

(Billfish; Spearfish; Aguja Blanca; Aguja de Paladar.)

Head (to end of upper jaw) $2\frac{2}{5}$; depth 7 to 8. Length of caudal lobes $4\frac{1}{2}$. D. III, 39–6; A. II, 13–6. Nape elevated, the greatest depth of body opposite the opercle. Eye midway between opercle and tip of lower jaw. Dorsal inserted in front of base of pectorals, its height $\frac{2}{3}$ to $\frac{5}{6}$ in depth of body; caudal forked at an angle of 70 to 80 degrees. Dark blue above; whitish beneath; fins dark blue. Length 7 feet. Weight 40 to 100 pounds. West Indies; not rare on our coast, ranging occasionally northward to Cape Cod. Our species is here considered to be identical with the form found in southern Europe; but no direct comparison has yet been made. (*imperator*, emperor). (Eu.)

*Xiphias imperator*, Bloch & Schneider, Syst. Ichth., 93, pl. XXI, 1801, Mediterranean; after Duhamel.
*Tetrapturus belone*, Rafinesque, Caratteri, 54, pl. 1, fig. 1, 1810, Sicily; Cuvier & Valenciennes, Hist. Nat. Poiss., VIII, 280, 1831.
*Skeponopodus typus*, Nardo, Isis., XXVI, Col. 417, 1833, Adriatic.
*Tetrapturus georgii*, Lowe, Proc. Zoöl., Soc. Lond., VIII, 1840, 36, Madeira.
*Tetrapturus albidus*, Poey, Memorias, II, 237, 1861, Havana; Jordan & Gilbert, Synopsis, 420, 1883.
*Tetrapturus lessoni*, Canestrini, Arch. Zoöl., 259, pl. VII, 1861, Mediterranean.
*Histiophorus belone*, Günther, Cat., II, 513, 1860.
*Tetrapturus imperator*, Goode, Proc. U. S. Nat. Mus., 1881, 417.

### 1281. TETRAPTURUS AMPLUS, Poey.

(Aguja de Casta.)

Head $2\frac{3}{5}$; depth 5; length of caudal lobes $3\frac{1}{3}$. D. III, 38–7; A. II, 13–7. Body stouter than in *Tetrapturus imperator*, more convex at nape, the greatest depth behind opercle. Caudal forked at an angle of 90 to 100 degrees. Dorsal inserted rather behind base of pectorals, its height $\frac{3}{7}$ depth of body. Length 10 feet or more; reaches a weight of 400 to 800

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*If, as Dr. Goode suggests, the species called *imperator* is confined to the Mediterranean, the American species may stand as *Tetrapturus albidus*, or possibly as *T. georgii.* According to Lütken there are but four recognizable species of *Istiophoridæ* (*Histiophorus gladius* and *gracilirostris*; *Tetrapturus belone* and *herscheli*). He identifies both of the American species of *Tetrapturus* with *Tetrapturus indicus*, Cuvier & Valenciennes. This view is perhaps correct, but, as has been pertinently observed by Dr. Goode, the identity of the American species called *Tetrapturus albidus* and *Histiophorus americanus*, with their Old-World representatives, is yet unproved, and in many respects it is desirable to retain the American names until this identity is shown. "To unite species from widely distant localities, without ever having seen them, is very disastrous to a proper understanding of the problems of geographical distribution." (Goode, Proc. U. S. Nat. Mus., 1881, 427.)

Should Lütken's view prove correct, the following synonyms should be added to *Tetrapturus imperator* or *albidus*. We do not see any notable difference between the Amercan form, called *albidus*, and the European *imperator*, and so adopt the latter name for both. We have no means of comparing either with *indicus* or *herscheli*.

pounds. (Poey.) West Indies; not very common, and recorded by Poey only. (*amplus*, ample.)

*Tetrapturus amplus*, POEY, Memorias, II, 243, 1861, Havana; JORDAN & GILBERT, Synopsis, 420, 1883.

## Family CXXIII. XIPHIIDÆ.

### (THE SWORDFISHES.)

Fishes of great size, with the body elongate, naked, the young covered with rough granulations; upper jaw very much prolonged, forming a "sword," which is flattened horizontally and composed of the consolidated vomer, ethmoid, and premaxillaries. Teeth wanting in the adult, present in the young. Dorsal fin long, usually divided in the adult, continuous in the young, without differentiated spinous part, both parts composed of soft rays, the posterior portion much smaller than the anterior and placed on the tail, resembling the second dorsal of a shark; fin rays enveloped in the skin. Anal fin divided in the adult. Caudal peduncle slender, with a strong median keel. Caudal fin widely forked in the adult. Ventral fins entirely wanting; no pelvic arch. Gills of peculiar structure, the laminæ of each arch joined into one plate by reticulations. Gills 4, a slit behind the fourth; gill membranes separate, free from the isthmus. Pseudobranchiæ present; branchiostegals 7. Air bladder present; pyloric cœca very numerous. Intestinal canal long, with many folds. Air bladder simple, large. Vertebræ short, $14 + 12 = 26$ in number, the neural and hæmal spines normal; ribs very few. One species, an enormous fish of the open sea, rivaling the largest sharks in size and of immense strength of muscle. Very young or larval individuals differing much from the adults; the fins high, both jaws prolonged into a beak, and the head armed with long spines. (*Xiphiidæ*, part, Günther, Cat., II, 511, 512.)

## 409. XIPHIAS, Linnæus.

### (SWORDFISHES.)

*Xiphias*, LINNÆUS, Syst. Nat., Ed. x, 248, 1758, (*gladius*).

Swordfishes without teeth and without ventral fins. Body somewhat compressed. Dorsal fins 2, the anterior beginning opposite the gill openings, falcate and elevated, its height rather less than that of the body; second dorsal very small, on the tail, opposite the small second anal. In the young, teeth are present and the 2 dorsal fins are connected, the fin being elevated as in the species of *Istiophorus*. First anal similar to first dorsal, but smaller, less falcate, and far behind it; pectoral fins moderate, falcate. Skin naked, more or less rough, especially in the young, which have rudimentary scales. Sword flattened and trenchant. Caudal keel single. Intestines long, sinuous. Air bladder simple. Pelvic arch obsolete. Fishes of great size, reaching a weight of 300 to 400 pounds, the flesh red and rich in flavor, highly valued as food. (*ξιφίας*, the ancient name of *Xiphias gladius*, from *ξίφος*, a sword.)

### 1282. XIPHIAS GLADIUS, Linnæus.

(COMMON SWORDFISH; ESPADA; ESPADON; EMPERADOR.)

Head about 2½; depth about 5½; snout 3 in length. D. 40–4; A. 18–14; Vertebræ 14 + 12. Cleft of mouth extending beyond eye. Color dark metallic purplish above, dusky below; "sword" almost black above, below lighter; fins dark, with silvery sheen. Atlantic Ocean, on both coasts, most abundant between Cuba and Cape Breton; not rare off Cape Cod and the Newfoundland Banks; rather common in southern Europe; also found in the Pacific, occasionally taken about Santa Barbara Islands,* but not elsewhere recorded from the eastern Pacific. The object of extensive fisheries in the Atlantic. (*gladius*, sword.)

*Xiphias gladius*, LINNÆUS, Syst. Nat., Ed. x, 248, 1758, Europe; after *Xiphias*, of ARTEDI; BLOCH, Ichthyologia, pl. 76, 1784; CUVIER & VALENCIENNES, Hist. Nat. Poiss., VIII, 255, 1831; GÜNTHER, Cat., II, 511, 1860; STORER, Fishes Mass., 71, 1867; JORDAN & GILBERT, Synopsis, 420, 1883.

*Xiphias rondeleti*, LEACH, in Wern. Mem., II, 58, pl. 2, fig. 1, 1818, Frith of Forth.

## Family CXXIV. NEMATISTIIDÆ.

(THE PAPAGALLOS.)

Body oblong, compressed, regularly diminishing in height toward the caudal; the caudal peduncle moderately reduced. Scales cycloid and small, but conspicuous, arranged in moderately oblique rows above and less oblique ones below. Lateral line simple and unarmed, scarcely convex anteriorly and not angulated. Head little longer than high, compressed and trenchant above, with the profile strongly decurved from the dorsal fin to the eyes, the snout oblique. Eyes in the anterior half of the head, near the snout and the profile. Nostrils double, in front of the eyes. Suborbital bones low. Opercula unarmed. Mouth rather large, the cleft very oblique and continued under the eyes. Teeth villiform, small, present on the vomer and palatine bones. Branchiostegals 6. Dorsal fins 2, folding in a deep sheath; the first with 8 very long filamentous spines; the second low, long; anal fin low and oblong, shorter than the second dorsal and with 1 slender spine, which is attached to the soft rays by membrane for its whole length; caudal fin forked and acutely lobed; pectoral fins long, acuminate; ventral fins large, inserted under the bases of the pectorals; each with a long, slender, compressed spine contiguous to the first ray, and with 5 rays, the internal of which is compound, and has several contiguous branches nearly or quite distinct, thus appearing like several rays. A single species known, a large, showily colored fish, found on the Pacific coasts of tropical America. The group is closely related to the *Carangidæ*, especially to *Seriola*. It is, however, well distinguished by the peculiar development of its anal and dorsal spines and by the structure of its ventral fins. (*Nematistioidæ*, Gill, Proc. Ac. Nat. Sci. Phila., 1863.)

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*One very large specimen was seen by Jordan & Gilbert in 1880, off Anacapa Island; another taken off Santa Rosa Island, was exhibited at the San Francisco Midwinter Fair in 1894; another seen near Cerros Island by Thos. C. Williams, December, 1894.

## 410. NEMATISTIUS, Gill.

*Nematistius*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 258, (*pectoralis*).
*??* *Seriolophus*,[*] GUICHENOT, Mém. Soc. Sci. Nat. Cherbourg, XIII, 90, 1868, (*carangoides*).

This genus is allied to *Seriola*, from which it differs notably in the development of the spinous dorsal and the pectoral fins, the dorsal being composed of 8 very long filamentous spines, the pectorals being falcate, acuminate, and nearly twice as long as the ventrals. The lateral line is nearly straight and is not keeled on the caudal peduncle. Ventrals I, 5, the inner ray much branched to the base so that the number of rays appears much greater than it really is. One species known; a large fish of an imposing appearance. (*νῆμα*, thread; *ἱστίον*, sail.)

### 1283. NEMATISTIUS PECTORALIS, Gill.

(PEZ DE GALLO; PAPAGALLO.)

Head $3\frac{1}{2}$; depth $2\frac{6}{7}$; eye 5 in head in young; snout 4. D. VIII–I, 27 or 28; A. I, 17; scales 119. Body oblong, compressed; caudal peduncle slender. Scales very small and inconspicuous; lateral line simple and unarmed. Mouth rather large, very oblique, the cleft continued under the eyes. Teeth villiform, small. Dorsal fins 2, folding into a deep sheath, the first with 8 long filamentous spines, the second low and elongate; anal fin low, long, but shorter than second dorsal; pectoral fin very long and falcate. Color plumbeous on the back and opercles; sides golden; an indigo-blue cross band on the snout, another on the forehead, a third band from nape to subopercles; a broad indigo band from first dorsal spine to near vent; a curved band from sixth dorsal spine downward and across to base of upper caudal rays; dorsal spines banded with alternate blue black and white; lower half of pectoral black. Length of adult 4 feet or more. Gulf of California to Panama, generally common; one of the most stately fishes in our waters, its long rays brightly colored, giving a striking appearance. Recorded from Cape San Lucas, Guaymas, Picheluogo, Mazatlan, Magdalena Bay and Panama. (*pectoralis*, pertaining to the pectoral.)

*Nematistius pectoralis*, GILL, Proc. Ac. Nat. Sci., Phila., 1862, 259, Cape San Lucas; (Coll. Xantus); STEINDACHNER, Ichth. Beitr., IV, 11, 1875; JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1881, 277; *ibid*, 1885, 375; JORDAN, Catalogue, 72, 1885; EVERMANN & JENKINS, Proc. U. S. Nat. Mus., 1891, 140.

*? Seriolophus carangoides*, GUICHENOT, Mém. Soc. Sci. Nat. Cherbourg, XIII, 90, 1868, locality unknown.

## Family CXXV. CARANGIDÆ.[†]

(THE PAMPANOS.)

Body more or less compressed and often elevated, sometimes naked, or more usually covered with small, thin, cycloid scales. Head compressed, the occipital keel prominent, usually trenchant. Mouth of varying size, the dentition various, the teeth generally small; premaxillaries usually protractile; maxillary with or without a supplemental bone; preopercle usually entire in the adult, in the very young armed with 3 or more spines. Lateral line complete, anteriorly arched, the posterior part straight, sometimes armed with bony plates. Dorsal fins more or less separated, the spinous part rather weak, the spines usually depressible in a groove; anal fin long, similar to the soft dorsal, always preceded by two stiff spines, usually separate, but in the young often more or less connected with the fin or with each other; these sometimes disappear with old age, and sometimes the spinous dorsal also vanishes; often a procumbent spine before the dorsal fin; ventral fins thoracic, well developed, I, 5; caudal peduncle very slender, the fin widely forked; pectoral fins narrow. Gill openings very wide, the membranes usually not united, free from the isthmus. Gills 4, a slit behind the last. Gill rakers usually long. Branchiostegals commonly 7. Air bladder present, often bifurcate behind. Pseudobranchiæ large, present in all our genera, sometimes disappearing with age. Œsophagus unarmed. Pyloric cœca generally numerous. Vertebræ fewer than in the *Scombridæ*, usually $10 + 14 = 24$ in number. First superior pharyngeal without teeth; second, third, and fourth separate, with teeth; lower pharyngeals separate. Coloration generally metallic and silvery or golden. Genera 29; species about 200, abounding in warm seas, often moving northward in summer, like the *Scombridæ*. They swim swiftly, often with the dorsal fin above the surface of the water. Most of the species are widely distributed, and nearly all are valued as food. (*Carangidæ*, part, Günther, Cat., II, 417–485, 1860, exclusive of certain genera.)

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[*] *Seriolophus*, according to Guichenot, is distinguished from *Seriola* in having the dorsal spines much prolonged and filiform; all the opercular bones covered with scales. D. VIII–I, 30; A. II, I, 16.

[†] For an account of the transformations of various members of this family, see Lütken, Spolia Atlantica, 1880.

Scombroidinæ:
*a*. Premaxillaries not protractile (except in the very young); pectoral fins short, rounded; soft dorsal similar to anal, both much longer than abdomen; lateral line unarmed.
  *b*. Maxillary without supplemental bone; no pterygoid teeth; scales linear, embedded. Oligoplites, 411.
*aa*. Premaxillaries protractile.
  *b*. Anal fin much shorter than soft dorsal, its base not longer than the abdomen.
   Seriolinæ:
    *c*. Pectoral fin short, not falcate; maxillary with a distinct supplemental bone.
     *d*. Dorsal spines low and weak.
      *e*. Dorsal and anal fins without finlets.
       *f*. Membrane of dorsal spines disappearing with age. Naucrates, 412.
       *ff*. Membrane of dorsal spines persistent. Seriola, 413.
      *ee*. Dorsal and anal fins each with a detached two-rayed finlet. Elagatis, 414.
  *bb*. Anal fin about as long as soft dorsal, its base longer than abdomen.
    *g*. Maxillary with a supplemental bone; lateral line arched anteriorly, usually armed posteriorly; pectoral long, falcate.
    Caranginæ:*
     *h*. Dorsal outline more strongly curved than ventral outline.
      *i*. Dorsal and anal each with a single detached finlet; body slender. Decapterus, 415.

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* The genera of *Caranginæ* here recognized are all closely allied to *Caranx*, and the known species form an almost unbroken series from *Decapterus* on the one extreme to *Selene* on the other. They might well all be reunited with *Caranx* as Günther and others have proposed.

*ii.* Dorsal and anal without finlets.

*j.* Lateral line with well-developed scutes for its entire length; body elongate. TRACHURUS, 416.

*jj.* Lateral line with scutes on its straight posterior portion only (these sometimes very few and small, especially in those species with the body much compressed).

*k.* Shoulder girdle with a deep cross furrow at its junction with the isthmus, above which is a fleshy projection; body elongate. TRACHUROPS, 417.

*kk.* Shoulder girdle normal, its surface even; body deeper.

*l.* Body oblong or more or less elevated, not as below.

*m.* Teeth of jaws in few series or in one series, unequal, or at least not forming villiform bands, the outer series above usually enlarged, the lower teeth usually uniserial.

*n.* Maxillary very narrow, its greatest width scarcely ¼ eye; head small; lateral line strongly arched in front; teeth uniserial, those on palatines and vomer minute or obsolete. HEMICARANX,

*nn.* Maxillary broad; head rather large; vomer and palatines with teeth. CARANX, 419.

*mm.* Teeth of jaws equally small or wanting, forming villiform bands if present; maxillary broad; body compressed; spinous dorsal weak, usually disappearing with age.

*o.* Teeth very minute, disappearing in the adult; no teeth on vomer or palatines; dorsal spines low and weak. GNATHANODON, 420.

*oo.* Teeth persistent, in bands; vomer and palatines with minute teeth.

*p.* Soft dorsal with none of its rays produced in filaments; lateral line nearly straight; body oblong. CARANGOIDES, 421.

*pp.* Soft dorsal with 1 to 6 rays produced in filaments.

*q.* Body moderately compressed; spinous dorsal more or less persistent. CITULA, 422.

*qq.* Body deep, greatly compressed, its edges all trenchant.

*r.* Soft dorsal lobe very high, filamentous. ALECTIS, 423.

*rr.* Soft dorsal lobe low. HYNNIS, 424.

*ll.* Body broad ovate, very strongly compressed, its outlines everywhere trenchant, the anterior profile nearly vertical; scutes almost obsolete. VOMER, 425.

*jjj.* Lateral line without any scutes; body short and elevated, strongly compressed. SELENE, 426.

CHLOROSCOMBRINÆ:

*hh.* Dorsal outline less strongly curved than ventral; body much compressed, its outlines everywhere trenchant; armature of lateral line obsolete or nearly so. CHLOROSCOMBRUS, 427.

TRACHINOTINÆ:

*gg.* Maxillary without supplemental bone; anal fin similar to soft dorsal, its base much longer than abdomen; tail unarmed; pectoral short, not falcate.

*s.* Forehead convex; teeth small or deciduous. TRACHINOTUS, 428.

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* A detailed account of the American species of *Caranginæ* is given by Jordan & Gilbert, Proc. U. S. Nat. Mus., 1883, 188–207.

## 411. OLIGOPLITES,[*] Gill.

### (Leather Jackets.)

*Oligoplites*, Gill, Proc Ac. Nat. Sci. Phila., 1863, 166, (*occidentalis* = *saurus*).

Body compressed, oblong or lanceolate. Caudal peduncle slender, not keeled. Head short, compressed, acute. Occipital keel sharp. Mouth rather large, with small sharp teeth in bands on jaws, tongue, vomer, and palatines, none on the pterygoids. Jaws about equal, the upper not protractile, except in the very young, in which it is movable as in other *Carangidæ*; maxillary very narrow, without distinct supplemental bone. Gill rakers rather long. Scales small, linear, and extremely narrow, embedded in the skin at different angles. Lateral line unarmed. Dorsal spines rather strong, 3 to 5 in number, nearly free in the adult; second dorsal very long, its posterior rays pencillated and nearly or quite disconnected, forming finlets; anal rather longer than soft dorsal, much longer than the abdomen, its last rays forming similar finlets ; anal spines strong ; ventral fins depressible in a groove; pectoral fins very short. Species few, in the tropical seas of America. (ὀλίγος, few ; ὁπλίτης, armed.)

*a.* Body rather elongate, elliptical, the depth about 4 in length.
  *b.* Maxillary not reaching posterior border of eye; lowest infraorbital bone usually narrower than the one above it. SAURUS, 1284.
  *bb.* Maxillary reaching beyond posterior border of eye; lowest infraorbital bone usually broader than the one next above it. SALIENS, 1285.
*aa.* Body rather deep, the depth in adult about 3 in length of body; lowest infraorbital bone broader than the one above it; maxillary nearly reaching posterior margin of eye. ALTUS, 1286.

### 1284. OLIGOPLITES SAURUS (Bloch & Schneider).

(Leather Jacket; Runner; Zapatero; Quiebra; Sauteur.)

Head 5 ; depth 4. D. V–I, 20 ; A. II–I, 20. Body lanceolate, slender, and compressed. Eye as long as snout, about 4 in head ; opercles short. Maxillary reaching beyond middle of orbit, nearly to its posterior edge; lowest bone of infraorbital series usually narrower than the bone above it. Scales very long and narrow, embedded in the skin, placed obliquely at angles with each other, their appearance unlike ordinary scales. Fins low ; pectoral as long as eye and snout; caudal very deeply forked, the lobes equal. Bluish above, bright silvery below ; fins yellow. Both coasts of Tropical America, very common in the West Indies and along the Florida Coast, ranging north to New York and Lower California ; not valued as food, being dry and bony. The Pacific Coast form called *inornatus* seems to us inseparable from *saurus*. (*saurus*, σαῦρος, lizard.)

*Scomber saurus*, Bloch & Schneider, Syst. Ichth., 321, 1801, Jamaica; based on the *Leather Coat* or *Saurus argenteus* of Browne.

*Chorinemus occidentalis*, Günther, Cat., II, 475, 1860; not *Gasterosteus occidentalis*, Linnæus, which is some other Carangoid fish seen by Linnæus in the Museum de Geer; the description unidentifiable.

*Oligoplites occidentalis*, Gill, Proc. Ac. Nat. Sci. Phila., 166, 1863.

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[*] In the Old-World genus *Scombroides* there are seven dorsal spines, the pterygoids are armed with teeth, and in most of the species the scales are normally developed.

*Centronotus argenteus*, Lacépède, Hist. Nat. Poiss., iii, 316, 1802, Equatorial America.

*Lichia quiebra*, Quoy & Gaimard, Voy. Freyc., Zoöl., 365, 1824, Equatorial America.

*Chorinemus saltans*, Cuvier & Valenciennes, Hist. Nat. Poiss., viii, 393, 1831, Martinique; Brazil, and San Domingo.

*Chorinemus quiebra*, Cuvier & Valenciennes, *l. c.*, viii, 396, 1831.

*Scombroides occidentalis*, Jordan & Gilbert, Synopsis, 447, 1883.

*Oligoplites inornatus*, Gill, Proc. Ac. Nat. Sci. Phila., 166, 1863, Panama.

*Chorinemus inornatus*, Günther, Fish Centr. Amer., 433, 1869.

*Oligoplites saurus*, Jordan & Gilbert, Synopsis, 973, 1883; Jordan, Proc. U. S. Nat. Mus., 1885, 375.

### 1285. OLIGOPLITES SALIENS (Bloch).

(Sauteur.)

Head 5½ in total length with caudal; depth 4½ (with caudal). D. IV–I, 19; A. II–I, 20. Upper maxillary very narrow posteriorly, reaching beyond vertical from posterior rim of orbit; length of intermaxillary half that of head; snout a little longer than eye; the infraorbital, situated above the maxillary, is broader than the bone next above it; none of these bones reach to anterior preopercular edge. Posterior margin of infraorbital ring nearly vertical. Coloration uniform. (Günther.) West Indies; not seen by us; perhaps not distinct from *Oligoplites saurus*. Length 1 foot. (*saliens*, leaping.)

*Scomber saliens*, Bloch, Ichthyologia, pl. 335, 1793. See Vol. x.

*Scomberoides saltator*, Lacépède, Hist. Nat. Poiss., ii, pl. 19, fig. 2, 1800.

*Chorinemus saliens*, Cuvier & Valenciennes, Hist. Nat. Poiss., viii, 389, 1831.

*Oligoplites saliens*, Günther, Cat., ii, 475, 1860.

Represented in Lake Maracaibo, in fresh or brackish waters, by

### 1285a. OLIGOPLITES SALIENS PALOMETA (Cuvier & Valenciennes).

Entirely similar, but with the posterior margin of the infraorbital ring deeply concave. (Günther.) Lake Maracaibo, Venezuela; said to be a food-fish of some importance. (*palometa*, a Spanish name applied to various species of *Bramidæ*, *Stromateidæ*, and *Carangidæ*.)

*Chorinemus palometa*, Cuvier & Valenciennes, Hist. Nat. Poiss., viii, 392, 1831, Lake Maracaibo.

### 1286. OLIGOPLITES ALTUS (Günther).

(Jurel; Monda.)

Head 3⅕ to 4½; depth 3 to 3½; eye 3⅖ to 4 in head; snout 3⅖ to 4 in head; maxillary very narrow, 1⅗ in head, not quite reaching posterior border of orbit. D. V–I, 19; A. II–I, 19. Lower jaw projecting. Lowest bone of infraorbital broader than the bone above it. Pectoral fin longer than the ventral, nearly as long as the head without snout. Body much deeper and more compressed than in other species. Color silvery, bluish above. Pacific Coast of tropical America from Mazatlan to Panama; a pretty fish, rather common, easily distinguished by the deep body. (*altus*, high.)

*Chorinemus altus*, Günther, Fishes Centr. Amer., 433, 1869, Panama.

*Oligoplites altus*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 374; *ibid*, Bull. U. S. Fish. Comm., 1882, 106 and 110; Jordan, Proc. U. S. Nat. Mus., 1885, 375.

## 412. NAUCRATES, Rafinesque.

(Pilot-fishes.)

*Centronotus*, Lacépède, Hist. Nat. Poiss., iii, 311, 1802, (*conductor*); not *Centronotus* of Bloch & Schneider, 1801, which is *Pholis*.
*Naucrates*, Rafinesque, Caratteri di Alcuni Nuovi Generi, &c., 1810, 44, (*conductor*).
*Pomphilus*, Minding, Lehrb. Nat. Fische, 108, 1832, (*ductor*).
*Nauclérus*, Cuvier & Valenciennes, Hist. Nat. Poiss., 247, 1833, (*compressus*; young).
*Xystophorus*, Richardson, Voyage Erebus and Terror, 52, 1844; very young.

This genus differs from *Seriola* only in the reduction of the spinous dorsal to a few (4 or 5) low, unconnected spines. The young, called *Nauclerus* and *Xystophorus*, have the spines of the dorsals connected by membrane, and a more or less distinct strong spine at the angle of the operculum. A single pelagic species widely distributed in the open seas. (*ναυκράτης*, ruler of the ships, *i. e.*, holding ships fast—a name applied by the ancients to *Echeneis* and other fishes.)

### 1287. NAUCRATES DUCTOR, Linnæus.

(Pilot-fish; Romero.)

Head 4; depth 4. D. IV-I, 26; A. II-I, 16. Body rather elongate, little compressed. Snout rather blunt; mouth terminal, oblique, small; maxillary scarcely reaching orbit. Caudal keel large, fleshy; pectorals short and broad; ventrals rather large. Bluish, with 5 to 7 broad dark vertical bars, extending on the fins. Length 2 feet. A pelagic fish found in all warm seas; occasional on our Atlantic Coast from Cape Cod to the West Indies; not common in markets or in collections. (*ductor*, leader.) (Eu.)

*Gasterosteus ductor*, Linnæus, Syst. Nat., Ed. x, 295, 1758, "in Pelago."
*Naucrates ductor*, Günther, Cat., ii, 374, 1860; Jordan & Gilbert, Synopsis, 443, 1883; Gill, Proc. U. S. Nat. Mus., 1882, 490.
*Gasterosteus antecessor*, Daldorf, Skriv. Nat. Selskab. Kjob., ii, 166, 1800.
*Scomber kœlreuteri*, Bloch & Schneider, Syst. Ichth., 570, 1801.
*Centronotus conductor*, Lacépède, Hist. Nat. Poiss., iii, 311, 1802, no locality.
*Naucrates fanfarus*, Rafinesque, Caratteri, 1810, 45, Sicily.
*Naucrates indicus*, Lesson, Voy. Coquille, 157, 1829, India.
*Naucrates noveboracensis*, Cuvier & Valenciennes, Hist. Nat. Poiss., viii, 325, 1831, New York.
*Seriola dussumieri*, Cuvier & Valenciennes, *l. c.*, ix, 217, 1833, Gulf of Bengal.
*Seriola succincta*, Cuvier & Valenciennes, *l. c.*, ix, 218, 1833, south of St. Helena.
*Nauclerus compressus*, Cuvier & Valenciennes, *l. c.*, ix, 249, 1833, Molucca.
*Nauclerus abbreviatus*, Cuvier & Valenciennes, *l. c.*, ix, 251, 1833, Atlantic Ocean.
*Nauclerus brachycentrus*, Cuvier & Valenciennes, *l. c.*, ix, 253, 1833, Indian Ocean.
*Nauclerus triacanthus*, Cuvier & Valenciennes, *l. c.*, ix, 253, 1833, Atlantic Ocean.
*Nauclerus annularis*, Cuvier & Valenciennes, *l. c.*, ix, 254, 1833, south of St. Helena.
*Nauclerus leucurus*, Cuvier & Valenciennes, *l. c.*, ix, 255, 1833, south of St. Helena.
*Naucrates cyanophrys*, Swainson, Classn. Fishes, ii, 412, 1839, Palermo.
*Naucrates serratus*, Swainson, *l. c.*, 413, 1839, Palermo.
*Thynnus pompilus*, Gronow, Cat. Fishes, 123, 1854, Palermo.
*Xystophorus*, Richardson, Voy. Erebus and Terror, 52, 1844, Palermo.

## 413. SERIOLA, Cuvier.

### (Amber-fishes.)

*Seriola*, Cuvier, Règne Anim., Ed. 2, II, 218, 1829, (*dumerili*).

*Halatractus*, Gill, Proc. Ac. Nat. Sci. Phila., 1862, 442, (*dumerili*; substitute for *Seriola*, used in botany).

*Micropteryx*, Agassiz, Pisc. Brasil., 1829, (*dumerili*; substitute for *Seriola*, used in botany; not *Micropterix*, Hübner, 1816, a genus of insects).

*Zonichthys*, Swainson, Nat. Hist. Classn. Fishes, II, 1839, 248, (*fasciatus*).

*Lepidomegas*,*, Thominot, Bull. Sci. Philom. Paris, 1880, IV, 173, (*muelleri*).

Body oblong, moderately compressed, not elevated. Occiput and breast not trenchant. Head usually more or less conical, not very blunt. Mouth comparatively large, with broad bands of villiform teeth on both jaws, tongue, vomer, and palatines; a broad, strong, supplemental maxillary bone; premaxillaries protractile. Scales small; lateral line scarcely arched, forming a keel on the caudal peduncle, not armed with bony plates; sides of head with small scales. First dorsal with about seven low spines, connected by membrane; second dorsal very long, elevated in front; anal similar to the soft dorsal but not nearly so long, shorter than the abdomen, preceded by two very small free spines, which disappear in old fishes; no finlets; ventral fins very long; pectorals short and broad. Gill rakers moderate. Species of moderate or large size, often gracefully colored; most of them valued as food-fishes. (*Seriola*, the Italian name of *Seriola dumerili*.)

Seriola:

*a.* Head longer than deep, the profile not very steep. Dorsal and anal fins not falcate, the height of their lobes less than half depth of body. Dorsal rays 30 to 38; species of large size, elongate, with 5 or 6 broad, dark cross bars when young, these becoming obsolete with age; a yellow lateral band; nuchal bar pale.

  *b.* Dorsal rays 36 to 38; dark bands on young very broad.

    *c.* Mouth smaller, the maxillary barely reaching front of pupil, 2⅔ in head. Head 4 in length. DORSALIS, 1288.

    *cc.* Mouth large, the maxillary reaching middle of orbit, 2⅙ in head. Head 3½ in length. ZONATA, 1289.

  *bb.* Dorsal rays 30 to 34. Mouth rather large, the maxillary reaching middle of pupil; dark bands on young broad.

    *d.* Body slender, depth 3½ to 3¾ in length. LALANDI, 1290.

    *dd.* Body deeper, the depth 3 in length. DUMERILI, 1291.

Zonichthys (ζονός, band; ἰχθύς, fish):

*aa.* Head deeper than long, the anterior profile steep; no yellow longitudinal band; size small.

  *e.* Dorsal not falcate, its soft rays 32; young with about 12 narrow dark cross bars.

    *f.* Body rather elongate, the depth 3⅗ in length; nuchal band obscure. MAZATLANA, 1292.

    *ff.* Body rather deep, the depth 3 in length; dark nuchal band distinct. FASCIATA, 1293.

  *ee.* Dorsal and anal falcate, their anterior lobes more than half depth of body; head deeper than long; body deep; dorsal rays 27 to 30.

    *g.* Nuchal band dark brown or black. RIVOLIANA, 1294.

    *gg.* Nuchal band pale yellowish. FALCATA, 1295.

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* Said to differ from *Seriola* in having no free anal spines and the first dorsal spine not turned forward, both characters being probably due to age.

### 1288. SERIOLA DORSALIS (Gill).

(Yellow-tail.)

Head 4; depth 4. D. V to VII-I, 35 to 39; A. II-I, 21. Body regularly fusiform, somewhat compressed, tapering to the sharp snout and slender caudal peduncle. Maxillary barely reaching front of pupil, 2⅔ in head; mouth not very large. Gill rakers long and strong. Head naked, except on the cheeks; fins scaleless. Caudal keel moderate; caudal lobes nearly equal. Spines of moderate development, the free anal spines disappearing with age; pectorals shorter than ventrals, which are half length of head; longest dorsal ray ⅔ height of body. Pyloric cœca very numerous. Bright steel blue above; sides dull silvery, an irregular yellowish lateral band; fins dusky yellowish green; caudal dull yellow; young with 10 indistinct dark bands, twice as wide as their intervals, the second between the second and fifth dorsal spines; dorsal and anal fins nearly black, the anterior angle of the latter lighter. Length 3 feet. Pacific Coast, from Point Concepcion southward to Mazatlan; abundant in summer about the Santa Barbara Islands. An excellent food-fish and much sought after by anglers. (*dorsalis*, pertaining to the back, from the long dorsal.)

*Halatractus dorsalis*, Gill, Proc. Ac. Nat. Sci. Phila., 1863, 84, Cape San Lucas. (Coll. Xantus.)

*Seriola lalandi*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1880, 456; not of Cuvier & Valenciennes.

*Seriola dorsalis*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 270 and 359; Rosa Smith, Proc. U. S. Nat. Mus., 1883, 234; Jordan, Proc. U. S. Nat. Mus., 1884, 123; Goode, Fishery Industries of U. S., 331, pl. 108, 1884; Jordan, Catalogue, 72, 1885; Jordan & Gilbert, Synopsis, 444, 1883; in part.

### 1289. SERIOLA ZONATA (Mitchill).

(Rudder-fish; Shark's Pilot.)

Head 3½; depth 3⅓. D. VII-I, 38; A. II-I, 21. Head longer than deep; profile descending in a gentle curve; top of head to base of dorsal fin compressed. Mouth small, nearly horizontal; maxillary reaching to below the middle of orbit. Pectorals small, rounded, as long as eye and snout; ventrals ⅔ length of head. Vent behind middle of body. Bluish above, white below; sides with about 6 broad black bars, these forming three large blotches on the dorsal and two on the anal; the bars growing faint or disappearing with age; an oblique dark band from the spinous dorsal to the eye, the space above this olivaceous; spinous dorsal black; ventrals mostly black. Length 2 to 3 feet. Cape Cod to Cape Hatteras; the banded young rather common northward. (*zonatus*, banded.)

*Scomber zonatus*, Mitchill, Trans. Lit. and Philos. Soc. N. Y., 1815, 427, New York Bay.

*Seriola zonata*, Günther, Cat., II, 465, 1860; Jordan & Gilbert, Synopsis, 445, 1883.

Represented south of Cape Hatteras by

### 1289a. SERIOLA ZONATA CAROLINENSIS, Holbrook.

Very similar to *Seriola zonata*, but more elongate, and paler in color.

Head 3½; depth 4⅔; eye 6⅓. D. V to VII-I, 36 or 37; A. II-I, 19 to 21. Body subfusiform, more slender, highest at origin of second dorsal, thence tapering evenly to snout and tail. Caudal peduncle somewhat depressed, with lateral carinæ and strong transverse grooves above and below; maxillary reaching vertical from middle of orbit, about $2\frac{1}{6}$ in head. Teeth villiform in jaws, on vomer, palatines, and in one median and two lateral series on tongue. Scales small on the cheeks, none on limb of preopercle or the remainder of the head. Adult bluish above, whitish beneath, a band of greenish yellow as wide as eye extending from preopercle to extremity of tail; fins greenish; traces of bands on the opercle; caudal dusky, not yellow; second dorsal and anal dusky; tip of dorsal pale; pectoral dusky; ventral creamy, its inner edge somewhat dusky; inside of mouth pale; young banded. Gulf of Mexico and South Atlantic Coast, common north to Cape Hatteras.

*Seriola carolinensis*, HOLBROOK, Ichthyol. S. C., 72, 1860, Charleston, South Carolina; JORDAN & GILBERT, Synopsis, 445, 1883.

*Seriola stearnsii*, GOODE & BEAN, Proc. U. S. Nat. Mus., 1879, 48, Pensacola, Florida. (Type, No. 22325. Coll. Stearns.)

### 1290. SERIOLA LALANDI, Cuvier & Valenciennes.

(GREAT AMBER-FISH; AMBER JACK; CORONADO.)

Head $3\frac{3}{4}$ to $4\frac{1}{4}$; depth $3\frac{1}{2}$ to $3\frac{3}{4}$. D. I, 34; A. I, 27; dorsal lobes $2\frac{1}{3}$ in head; maxillary $2\frac{1}{5}$. Body slender. Dorsal fin dusky, with a light-yellow submarginal band; pectorals dusky yellowish; ventrals yellow and blackish; anal blackish, with pale edge. Young and old specimens have essentially the same general form, being in all stages more slender than *Seriola dumerili*. A food-fish of some importance reaching a weight of 100 pounds and a length of 5 or 6 feet. West Florida to Brazil; rather common; occasionally north to New Jersey; the specimens here described from Key West. (Named for M. Delalande, a well-known naturalist, who collected fishes for Cuvier in Brazil.)

*Seriola lalandi*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IX, 208, 1833, Brazil; GÜNTHER, Cat., II, 463, 1860; STEINDACHNER, Ichthyol. Berich., V, 40, 1868; GOODE & BEAN, Bull. U. S. Fish Commission, I, 1881, 43; JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 271; JORDAN, Proc. U. S. Nat. Mus., 1884, 122 and 123.

*Seriola gigas*, POEY, Memorias, II, 227, 1860, Cuba.

*Zonichthys gigas*, POEY, Synopsis, 371, 1868.

### 1291. SERIOLA DUMERILI (Risso).

(AMBER JACK; CORONADO.)

Head $3\frac{1}{10}$; depth 3. D. VII-I, 32; A. II-I, 21. Lobes of dorsal and anal low, not quite half length of head. Nape scarcely carinated. Very close to *Seriola lalandi*, but reaching a smaller size, and with the body deeper and little compressed; mouth larger than in *S. dorsalis*, about as in *S. lalandi*, the maxillary reaching middle of pupil, $2\frac{1}{10}$ in head. Grayish, silvery below; a gilt band through eye to base of caudal; another through temporal region to front of soft dorsal; no dark cross bands; fins plain. Length 24 inches. Mediterranean to West Indies, north to Key West and Pensacola; common southward; a food-fish of some importance. (Named for A. M. Constant Duméril, ichthyologist of the Museum at Paris, about 1810, father of Auguste Duméril, 1870.) (Eu.)

*Caranx dumerili*,* Risso, Ichthyol. Nice, 175, pl. 6, fig. 20, 1810, Nice.

*Seriola dumerili*, Risso, Eur. Mérid., III, 424, 1827; Cuvier, Règne Animal, Ed. 2, 130, pl. 56, fig. 1, 1829; Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 201, pl. 258, 1833; Günther, Cat., II, 462, 1860; Steindachner, Ichth. Berichte, V, 40, 1868; Steindachner, Ichth. Beiträge, I, 20, 1874; Jordan, Proc. U. S. Nat. Mus., 1884, 122 and 123.

*Trachurus aliciolus*,* Rafinesque, Caratteri, 42, pl. XI, fig. 2, 1810, Sicily.

*Trachurus fasciatus*, Rafinesque, Indice d'Ittiologia Sicil., 21, No. 108, and app. 53, No. 12, 1810, Sicily; not *Scomber fasciatus* of Bloch.

*Seriola proxima*, Poey, Memorias, II, 229, 1860, Cuba.

### Subgenus ZONICHTHYS, Swainson.

### 1292. SERIOLA MAZATLANA, Steindachner.

Head $3\frac{3}{5}$; depth $3\frac{3}{5}$. D. VII–I, 32; A. II–I, 21. Eye $4\frac{1}{2}$ in head; snout 3. Maxillary not reaching middle of eye. Longest dorsal ray $2\frac{1}{3}$ in head; longest anal ray 3. Pectoral half as long as head; ventral $1\frac{3}{5}$ in head. Grayish, with numerous narrow bluish cross bands, more or less mottled with brown. Mazatlan; one young specimen known. Coloration as in *Seriola fasciata*, but the body formed more as in *Seriola dumerili.*

*Seriola mazatlana*, Steindachner, Ichth. Beiträge, V, 8, 1876, Mazatlan.

### 1293. SERIOLA FASCIATA (Bloch).

(Medregal.)

Head 4; depth $3\frac{2}{3}$. D. VIII–I, 32; A. II–I, 20. Body oblong oval, compressed. Maxillary reaching front of pupil; pectoral 8 in total length; second dorsal low, not falcate, its longest ray not half depth of body; anal similar, but lower. Grayish, with golden reflections, a brown band from eye to nape; no yellow longitudinal band; young with about 12 very narrow dark cross bands which disappear with age, these bands continued on the vertical fins; fins greenish. Size small. Length about one foot. (Poey.) West Indies north to Charleston; not very common; not seen by us. (*fasciatus*, banded.)

*Scomber fasciatus*, Bloch, Ichthyologia, pl. 341, 1793.

*Seriola fasciata*, Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 211, 1833; Günther, Cat., II, 464, 1860; Jordan & Gilbert, Synopsis, 445, 1883.

*Halatractus fasciatus*, Poey, Synopsis, 373, 1868.

*Seriola semicoronata*, Poey, Memorias, II, 232, 1860, Havana. The name *fasciata* was given by Poey to banded specimens, that of *semicoronata* to those from which the bands had disappeared.

### 1294. SERIOLA RIVOLIANA (Cuvier & Valenciennes).

Head $3\frac{1}{4}$; depth $3\frac{1}{12}$. D. I, 29; A. I, 20. Body elliptical, deep, compressed; the nape not very sharp; caudal keel weak. Head a little longer than deep; snout blunt, compressed, not conical, 3 in head; maxillary reaching to near middle of pupil, $2\frac{2}{5}$ in head. Dorsal fin falcate, its lobe $4\frac{4}{5}$ in length of body, $1\frac{3}{5}$ in depth, $1\frac{2}{5}$ in length of head, and $2\frac{1}{6}$ in base of fin. Olivaceous; a dark-brown or black band from eye to soft dorsal; the body otherwise plain. Mediterranean to Brazil, the West Indies, and South Carolina; occasional on the Florida Coast. (Named for the Duc de Rivoli, who collected the types of the species in Greece.) (Eu.)

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* We do not know which of the two names *duménili* and *aliciolus* has priority of date. We follow custom in recognizing the names of Risso given in 1810, in preference to those of Rafinesque of the same year. The far greater accuracy and value of the excellent work of Risso justifies this preference.

*Seriola rivoliana*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 207, 1833, the Greek Archipelago; Lütken, Spolia Atlantica, 603, 1880; Jordan & Gilbert, Synopsis, 444, 1883; Jordan & Gilbert, Proc. U. S. Nat. Mus., 1884, 123; Jordan, Proc. U. S. Nat. Mus., 1886, 532.
*Seriola boscii*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 208, 1833, South Carolina.
*Zonichthys bosci*, Gill, Cat. Fish. E. Coast N. A., 36, 1861.
*Halatractus bosci*, Gill, Proc. Ac. Nat. Sci. Phila., 1862, 442.
*Seriola bonariensis*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 211, 1833, Buenos Ayres; Poey, Memorias, ii, 232, 1860; Günther, Cat., ii, 464, 1860.
*Halatractus bonariensis*, Poey, Synopsis, 373, 1868.
*Seriola coronata*, Poey, Memorias, ii, 232, 1860, Cuba.
*Halatractus coronatus*, Poey, Synopsis, 373, 1868.
*Zonichthys coronatus*, Poey, Enumeratio, 83, 1875.

### 1295. SERIOLA FALCATA, Cuvier & Valenciennes.

(Madregal; "Rock Salmon.")

Head $3\frac{4}{5}$ ($4\frac{3}{5}$ in total); depth $3\frac{2}{5}$ (4 in total). D. VII-I, 29; A. II-I, 21. Cœca 30. Body rather deep and compressed. Head somewhat longer that deep, not conical. Snout $2\frac{2}{4}$ in head; maxillary reaching front of pupil, $3\frac{1}{2}$ in head, its tip broad; eye large, $5\frac{1}{4}$ in head, $1\frac{2}{4}$ in snout. Occiput somewhat carinated. Interorbital space wide, convex. Caudal keel little developed. Dorsal high, somewhat falcate, its anterior lobe $1\frac{2}{5}$ in head, $2\frac{1}{3}$ in the base of the fin; pectorals 2 in head; ventrals $1\frac{3}{5}$; anal lobe $1\frac{2}{4}$; anal spines small. Life coloration as follows: Grayish above, paler but hardly silvery below; fins blackish, the pectorals pale, the caudal not at all yellow; eye white; lining of opercle pale; a very obscure olivaceous band from eye to front of dorsal, scarcely visible in fresh specimens; preorbital and preopercle shaded with olive. West Indies, north to Florida and Carolina; more common than the preceding, with which it is probably identical, differing, so far as we can see, only in the faint color of the temporal band. If the two are the same, the name *Seriola rivoliana* should be used, as having priority. *Seriola fasciata* is apparently a different species. (*falcatus*, scythe-shaped).

*Seriola falcata*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 210, 1833, Gulf of Mexico; Günther, Cat., ii, 464, 1860; Lütken, Spolia Atlantica, 603, 1880; Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 271; Goode & Bean, Proc. U. S. Nat. Mus., 1882, 237; Jordan, Proc. U. S. Nat. Mus., 1884, 123.
*Seriola dubia*, Lowe, Proc. Zoöl. Soc. London, vii, 1839, 81, Madeira.
*Seriola declivis*, Poey, Memorias, ii, 230, 1860, Havana.
*Seriola ligulata*, Poey, Memorias, ii, 231, 1860, Cuba.
*Zonichthys declivis*, Poey, Synopsis, 372, 1868.

## 414. ELAGATIS, Bennett.

(RUNNERS.)

*Elagatis*, BENNETT, Narrative of a Whaling Voyage, II, 283, 1835, (*bipinnulata*).
*Seriolichthys*, BLEEKER, Natuurk. Tydschr. Nederl. Ind., VI, 196, 1854, (*bipinnulata*).
*Decaptus*, POEY, Memorias, II, 1860, 233, (*pinnulatus*).

Body long and slender. Second dorsal and anal long, each with one detached finlet composed of 2 rays behind the rest of the fin. Otherwise essentially as in *Seriola*. One species pelagic. (*ἠλακάτη*, a spindle.)

### 1296. ELAGATIS BIPINNULATUS (Quoy & Gaimard).

(RUNNER; YELLOW-TAIL.)

Head $3\frac{5}{6}$; depth $3\frac{3}{5}$; eye $5\frac{1}{2}$; snout $2\frac{3}{4}$. D. VI–I, 27, 2; A. II–I, 17, 2; scales about 100. Maxillary triangular, its greatest width $2\frac{1}{5}$ in its length; supplementary bone long and linear, all except its caudo-ventral margin slipping under the preobital; preorbital and preopercle entire. Length of mandible equal to distance from tip of snout to middle of pupil; distance from tip of upper jaw to posterior end of maxillary $3\frac{1}{6}$ in head. Body oblong, elliptical, the back little elevated; head rather long and pointed, the mouth terminal; a slight occipital keel. Gill rakers about all below the angle, cephalic ones gradually shorter, the longest about $1\frac{1}{2}$ in eye. Lateral line wavy, origin at dorsal edge of opercle, the cephalic end running slightly dorsal to opposite origin of spinous dorsal, then turning slightly ventral until opposite origin of anal fin, and then median to caudal fin. Origin of soft dorsal slightly nearer tip of snout than base of caudal; spinous dorsal low, the third and fourth spines longest, about $5\frac{1}{2}$ in head; soft dorsal and anal similar, each slightly falcate; longest dorsal ray $2\frac{3}{4}$ in head, the thirteenth shortest, $6\frac{1}{2}$ in head; second ray of dorsal finlet twice length of first, or 4 in head; longest anal ray $3\frac{1}{2}$ in head, about as long as second ray of finlet; the two small anal spines remote from the rest; pectorals short and broad, nearly 2 in head; ventrals short, 2 in head, folding in a ventral depression; caudal widely forked, the lobes attenuate and slightly longer than head. Body covered with small cycloid scales; head naked, except portion of cheeks and part of its dorso-caudal margin; scales on cheeks in about 6 series, those on nape smaller than those on upper portions of body. Color dark blue or lead above, becoming pale yellowish below; two conspicuous blue bands on sides of body, the upper one beginning at the orbit and passing to dorsal margin of caudal peduncle, its width about equal to diameter of eye; the other beginning at snout and passing along lower margin of orbit, across opercle and above pectoral fin to caudal; caudal yellowish, with a darker margin; ventrals and pectorals yellowish, with some blue. Length $2\frac{1}{2}$ feet. Tropical seas, occasionally in the West Indies, straying northward to Long Island, where the specimens upon which the above description is based were secured by Dr. Meek. (*bi-pinnulatus*, with two pinnules.)

*Seriola bipinnulata*, QUOY & GAIMARD, Voy. Uranie, Zoöl., I, 363, pl. 61, fig. 3, 1824, Keeling Islands.

*Seriola pinnulata*,* POEY, Memorias, II, 233, 1860, Havana.

*Elagatis bipinnulatus*, BENNETT, Whaling Voy., II, 283, 1835; MEEK & BOLLMAN, Proc. Ac. Nat. Sci. Phila., 1889, 42.

*Elagatis bipinnulata*, GÜNTHER, Cat., II, 468, 1860.

*Elagatis pinnulatus*, JORDAN & GILBERT, Synopsis, 446, 1883.

## 415. DECAPTERUS, Bleeker.

(MACKEREL SCADS.)

*Decapterus*, BLEEKER, Natuurk. Tydschr., v, 417, 1855, (*kurra*).

*Eustomatodus*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 261, (*kurroides*).

*Gymnepignathus*, GILL, *l. c.*, 261, (*macrosoma*).

*Evepigymnus*, GILL, *l. c.*, 261, (*hypodus*).

Body elongate, little compressed, almost perfectly fusiform. Head short, pointed. Mouth rather small; jaws about equal, the dentition feeble; maxillary rather broad, with a supplementary bone. Premaxillaries protractile. Scales moderate, enlarged for the whole length of the lateral line, but spinous and bony posteriorly only; second dorsal and anal each with a single detached finlet; free anal spines very strong; first dorsal well developed, persistent; pectorals comparatively short. Abdomen rather shorter than anal fin. Gill rakers long and slender. Species numerous. (δέκα, ten; πτερόν, fin; there being 10 fins, counting the spurious finlets and excluding the free spines.)

- *a*. Shields of lateral line numerous, 40 to 50 in number; depth 5 in length; teeth present on jaws, vomer, and palatines; none on tongue.
  - *b*. Dorsal with 30 soft rays; lateral line anteriorly with about 12 distinct, small black points. PUNCTATUS, 1297.
  - *bb*. Dorsal with 27 soft rays. SCOMBRINUS, 1298.
- *aa*. Shields of lateral line few, 20 to 30 in number.
  - *c*. Teeth minute on both jaws, vomer, palatines, and tongue; shields 22 to 28; depth 5 in length. SANCTÆ-HELENÆ, 1299.
  - *cc*. Teeth distinct on lower jaw and tongue; caudal keel of 30 distinct shields; depth 5½ in length. HYPODUS, 1300.
  - *ccc*. Teeth obsolete; caudal keel of 25 shields; depth 5¾ in length. MACARELLUS, 1301.

### 1297. DECAPTERUS PUNCTATUS (Agassiz).

(SCAD; ROUND ROBIN; CIGAR-FISH; QUIA-QUIA.)

Head 4½; depth 5. D. VIII–I, 30–I; A. II–I, 24–I. Eye rather small, shorter than snout, about equal to the width of cheeks or the interorbital space. Maxillary reaching front of eye. Teeth on vomer and palatines, none on tongue; teeth in jaws in single series. Lateral line little arched; arch of lateral line nearly as long as straight part; scutes numerous, deep, crowded, about 40. Pectorals short, shorter than head. Breast, cheeks, and top of head scaly. Bluish above, silvery below; a dark opercular spot. Length 12 inches. Cape Cod to Brazil; occasionally northward; very common on the coasts of Florida and in the West Indies. (*punctatus*, dotted.)

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* There seems to be no difference between the American form called *pinnulatus* and the East Indian *bipinnulatus*.

*Scomber hippos*, MITCHILL, Trans. Lit. & Phil. Soc. N. Y., I, 1815, pl. 5, fig. 5; not of LINNÆUS.
*Caranx punctatus*, AGASSIZ, Spix, Pisc. Bras., 108, plate 56a, fig. 2, 1829, Brazil; CUVIER & VALENCIENNES, Hist. Nat. Poiss., IX, 38, 1883, GÜNTHER, Cat., II, 426, 1860.
*Caranx suareus* (RISSO), CUVIER & VALENCIENNES, Hist. Nat. Poiss., IX, 33, 1883, Mediterranean.
*Decapterus punctatus*, POEY, Synopsis, 368, 1875; JORDAN & GILBERT, Synopsis, 432, 1883; JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1883, 189.

### 1298. DECAPTERUS SCOMBRINUS (Valenciennes).

Head 3½; depth 4⅔. D. IX–I, 27–I; A. II, 23–I; scales 42, lateral line very slightly bent. Eye large, 3½ in head; snout equaling eye; pectoral 1¼ in head. Greenish above; paler below; no distinct opercular spot; no black spots in figure. (Günther, after Valenciennes.) Galapagos Islands; not seen by us. Close to *Decapterus punctatus*, the dorsal apparently shorter. (*scombrinus*, mackerel-like.)

*Caranx scombrinus*, VALENCIENNES, Voyage de la Venus, 332, pl. 7, fig. 1, 1846, Galapago Islands; GÜNTHER, Cat., II, 426, 1860.

### 1299. DECAPTERUS SANCTÆ-HELENÆ (Cuvier & Valenciennes).

Head 4⅓; depth 5. D. VIII–I, 32–I; A. II–I, 27 or 28–I. Shields 28 to 32 (in Japanese examples; 22 to 28 in specimens from St. Helena; Steindachner); pectoral 1¼ in head. Maxillary reaching front of eye; eye moderate, rather shorter than snout. Teeth minute, in single series in jaws; also on vomer, palatines, and tongue. Bluish, a black opercular spot; tip of soft dorsal brown. Tropical parts of the Atlantic, on both coasts of South America; not seen by us. According to Poey this species occurs in Cuba, where it differs from *Decapterus punctatus* in having its scutes subdenticulate, less narrow, and beginning much behind the origin of the anal. According to Steindachner this species is identical with a common Japanese species, *Decapterus muroadsi* (Temminck & Schlegel).

*Caranx sanctæ-helenæ*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IX, 37, 1833, St. Helena.
*Decapterus sanctæ-helenæ*, POEY, Synopsis, 368, 1868; JORDAN & GILBERT, Synopsis, 190, 1883; STEINDACHNER & DÖDERLEIN, Fische Japans., III, 17, pl. 4, fig. 1, 1884.
? *Caranx muroadsi*, TEMMINCK & SCHLEGEL, Fauna Japonica, 108, pl. 58, fig. 1, 1842, Japan; GÜNTHER, Cat., II, 425, 1860.

### 1300. DECAPTERUS HYPODUS, Gill.

Head 4 in total; depth nearly 5. D. VII–I, 21–I; A. II–I, 26–I; scales 70 + 30, lateral line with a very slight sigmoidal flexure, and covered with very conspicuous scales, trifid on each scale. Teeth on lower jaw small and uniserial; tongue with a longitudinal narrow band. Color above greenish blue, the opercular spot small. Cape San Lucas; five specimens known. It is perhaps a subspecies of *Decapterus macarellus*, the differences in the size of the teeth being of minor importance and of doubtful permanence, and both forms may be inseparable from *Decapterus sanctæ-helenæ*. (ὑπό, below; ὀδούς, tooth.)

*Decapterus hypodus*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 261, Cape San Lucas; (Coll. Xantus); JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 358.

### 1301. DECAPTERUS MACARELLUS (Cuvier & Valenciennes).

(Mackerel Shad; Antonino.)

Head 5; depth 6. D. VIII–I, 33–I; A. II–I, 27–I; teeth obsolete; scutes beginning at end of dorsal, 25 of them with keels. Lateral line nearly straight. Silvery, plumbeous below; a small black spot on the opercle. Warm parts of the Atlantic, straying northward to Cape Cod; scarce on our coast. Length 1 foot. (French *maquereau*, mackerel, the name applied to the species in Martinique.)

*Caranx macarellus*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 40, 1833, Martinique; Günther, Cat., ii, 426, 1860.

*Decapterus macarellus*, Poey, Enumeratio, 79, 1875; Jordan & Gilbert, Proc. U. S. Nat. Mus., 1883, 190; Jordan & Gilbert, Synopsis, 433, 1883.

## 416. TRACHURUS, Rafinesque.

(Saurels.)

*Trachurus*, Rafinesque, Indice d'Ittiologia Siciliana, 20, 1810, (*trachurus*).

*Trachurus*, Cuvier, Règne Animal, Ed. 1, 1817, (*trachurus*).

Body rather elongate, somewhat compressed, not elevated, tapering to a slender caudal peduncle, which is as broad as deep. Scales present, not very small. Lateral line armed throughout with plates, those on the caudal peduncle larger and spinous; an accessory dorsal branch to the lateral line. Snout rather long. Mouth moderate. Minute teeth mostly in single series on jaws, vomer, and palatines. Dorsals 2, the first preceded by a procumbent spine. No finlets. Two strong spines before the anal, connected by membrane. Pyloric cœca numerous. About 4 species known; found in all warm seas. (τραχοῦρος, the ancient name of *Trachurus trachurus*; from τραχύς, rough; οὐρά, tail.)

*a.* Body elongate, little compressed, the depth 5 in length; scutes about 96 (50 + 46 to 48) in number, the height of the anterior scutes ⅓ that of the posterior and about 2⅓ in diameter of eye; curved part of lateral line scarcely shorter than straight part; maxillary 2⅔ in head, reaching just beyond vertical from front of eye; lining of opercle scarcely blackish. PICTURATUS, 1302.

*aa.* Body comparatively deep and compressed, the depth 4 to 4⅙ in length; scutes about 72 (34 to 36 + 36 to 38) in number, the anterior scutes scarcely lower than the posterior, their height about 1¼ in diameter of eye; length of curved part of lateral line $1\frac{3}{7}$ to 1⅗ in straight part; maxillary reaching past front of pupil, 2¼ to 2⅛ in head; lining of opercle blackish. TRACHURUS, 1303.

### 1302. TRACHURUS PICTURATUS (Bowdich).

(Horse-mackerel; Xurel.)

Head 3¾; depth 5. D. VIII–I, 31; A. II–I, 27; scales 50 + 47 in California examples, 90 to 108 in others. Similar to *Trachurus trachurus*, but slenderer and less compressed and reaching a much larger size. Arch of lateral line longer, as long as straight part, the junction of the two much beyond tip of pectoral; plates on the anterior part small, crowded, their height less than half eye. Length 2 feet. Warm seas, especially common on the coast of California, from San Francisco southward to the Galapagos

Islands and Chili; not noticed on the coast of Mexico. Abundant in summer in the markets of San Francisco, where it is a food-fish of good quality. Also widely distributed in the open sea, reaching the Mediterranean and New Zealand. It has not been recorded from the east coast of either North or South America, where *Trachurus trachurus* is the only well-known species, even this being rare. The California species may prove separable from the Atlantic form, in which case it would stand as *Trachurus symmetricus*, Ayres; no difference is, however, known to us. Lütken records specimens from the West Indies, Azores, and Chili. (*picturatus*, pictured.) (Eu.)

*Seriola picturata*, Bowdich, Excursion to Madeira, 123, fig. 27, 1825, Madeira.

*Caranx picturatus*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 269.

*Trachurus picturatus*, Steindachner, Ichth. Berich., v, 34, 1868; Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 358; Jordan & Gilbert, Proc. U. S. Nat. Mus., 1883, 191; Jordan & Gilbert, Synopsis, 911, 1883.

*Caranx trachurus*, "deuxième subdivision," Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 17, 1833, Mediterranean; Valparaiso.

*Caranx cuvieri*, Lowe, Trans. Zoöl. Soc. Lond., ii, 1837, 183, Madeira.

*Caranx symmetricus*, Ayres, Proc. Cal. Ac. Nat. Sci., i, 1855, 62, San Francisco.

*Trachurus fallax*, Capello, Catal. Peix. Portugal, 310-318, 1867, Lisbon.

*Trachurus rissoi*, Giglioli, Catalogo degli Anfibi e Pesci Italiani, 27, 1880, Italy; based on *Caranx amia*, Risso.

*Caranx (Trachurus) cuvieri*, Steindachner, Ichth. Beitr., ii, 16, 1875.

*Trachurus cuvieri*, Lütken, Spolia Atlantica, 126, 1880.

*Trachurus symmetricus*, Gill, Proc. Ac. Nat. Sci. Phila., 1862, 261.

### 1303. TRACHURUS TRACHURUS (Linnæus).

(Saurel; Gascon.)

Head 3½; depth 4; eye large, equal to snout, 4 in head. D. VIII-I, 29; A. II-I, 28; scales 40 + 37. Body more compressed and deeper than in the preceding. Head rather long. Mouth moderate, the maxillary reaching the front of eye. Arch of lateral line short, reaching scarcely beyond pectoral, 1½ in straight part, the plates high, nearly as high anteriorly as posteriorly, their height more than half eye. Greenish, sides silvery; a dusky opercular spot. Length 1 foot. North Atlantic chiefly on the coasts of Europe, south to Spain and Naples; it is very rare on our coast, recorded from Newport, R. I., Pensacola, and Cape San Lucas. A third species, *Trachurus mediterraneus*, not known from America, largely replaces it in southern Europe. (Eu.)

*Scomber trachurus*, Linnæus, Syst. Nat., Ed. x, 1758, 298, Mediterranean Sea; after *Scomber linea laterali aculeata* of Artedi; D. VIII, 34; probably includes *Trachurus mediterraneus*.*

*Trachurus trachurus*, Bloch, Naturgesch. Ichthyologia, ii, 138, pl. 36, 1784; good figure and description of the northern species, here called *trachurus*.

*Caranx trachurus*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 11, 1833.

*Trachurus trachurus*, Steindachner, Ichth. Berich., v, 32, 1868; Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 269; Günther, Cat. (in part), ii, 419, 1860.

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*It is possible that the specific name *trachurus*, being based entirely on Mediterranean specimens, should be transferred to the commonest species of that region, now called *Trachurus mediterraneus*. In that case the name *Trachurus semispinosus* (Nilsson) is probably to be retained for the form here called *Trachurus trachurus*, which ranges farther northward than the others. Bloch's description of *trachurus* belongs to this form, and probably two or three species were confounded by Artedi and Linnæus, as by very many later writers.

? *Caranxomorus plumierianus*, LACÉPÈDE, Hist. Nat. Poiss., III, 84, pl. 11, 1802: scarcely identifiable; from a figure by PLUMIER, supposed to have been made in Martinique.

*Trachurus saurus*, RAFINESQUE, Indice d'Ittiol. Siciliana, 20, 1810; based on *Scomber trachurus* of LINNÆUS; JORDAN & GILBERT, Synopsis, 911, 1883; JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1883, 191.

*Caranx semispinosus*, NILSSON, Prodr. Ichthyol. Scand., 84, 1832, Scandinavia.

*Trachurus europæus*, GRONOW, Cat., Ed. Gray, 1854, 125, seas of Europe; after *Scomber linea laterali curvo omnino loricata* of GRONOW.

*Trachurus linnæi*, MALM, Bohusläns Fauna, 421, Bohuslän, Sweden.

*Trachurus trachurus*, LÜTKEN, Spolia Atlantica, 125, 1880.

## 417. TRACHUROPS, Gill.

*Trachurops*, GILL, Proc. Ac. Nat. Sci. Phila., 431, 1862, (*crumenophthalmus*).

This genus is close to *Caranx*, differing in the more elongate form and especially in the structure of the shoulder girdle which has a deep cross-furrow at its junction with the isthmus, with a fleshy projection above the furrow. Species few, found in all warm seas. (*Trachurus*; ὤψ, appearance.)

### 1304. TRACHUROPS CRUMENOPHTHALMUS (Bloch).

(GOGGLER; BIG-EYED SCAD; GOGGLE-EYE JACK; CHICHARRO.)

Head 3½; depth 3½; eye 3. D. VIII–I, 26; A. II–I, 22; scutes 35. Body oblong elongate, little compressed, the back not elevated. Head elongate, rather pointed, the lower jaw projecting; maxillary reaching past the front of the eye, which is very large, longer than snout, much deeper than the cheeks, and greater than the interorbital width. A single series of small teeth in each jaw; very weak teeth on vomer and palatines; a patch of teeth on tongue. Shoulder girdle near isthmus with a fleshy projection, in front of which is a deep cross furrow; adipose eyelid largely developed. Scales comparatively large. Cheeks and breast scaly. Gill rakers long, numerous. Lateral line scarcely arched, its scutes weak, but little carinated. Dorsal spines slender; free anal spines strong; pectorals falcate, shortish, about $1\frac{1}{7}$ in head. An angle at lower posterior part of opercular region as in *Clupea*. Bluish olive above, silvery below, a faint opercular spot. Length about 2 feet. Both coasts of tropical America, occasionally north to Cape Cod; common in the West Indies and on the west coast of Mexico; specimens examined by us from Cape San Lucas, Mazatlan, Acapulco, and Panama. We are unable to see any difference between the Pacific Coast form *Trachurus brachychirus*, Gill, and the ordinary *crumenophthalmus*. Specimens from Havana, Acapulco, and Mazatlan agree perfectly. Also found on the coast of Africa and in most tropical seas. (*crumena*, purse; ὀφθαλμός, eye.)

*Scomber crumenophthalmus*, BLOCH, Ichthyol., pl. 343, 1793, Acara in Guinea.

*Scomber plumieri*, BLOCH, Ichthyol., pl. 344, 1793, Antilles.

*Scomber balantiophthalmus*, BLOCH & SCHNEIDER, Syst. Ichth., 29, 1801, Guinea.

*Caranx macrophthalmus*, AGASSIZ, Spix, Pisc. Bras., 107, 1829, Brazil.

*Trachurops brachychirus*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 261, Cape San Lucas.

*Caranx crumenophthalmus*, LACÉPÈDE, Hist. Nat. Poiss., IV, 107, 1803; CUVIER & VALENCIENNES, Hist. Nat. Poiss., IX, 62, 1833; JORDAN & GILBERT, Synoposis, 434; and of recent writers generally; GÜNTHER, Cat., II, 429, 1860.

*Trachurops crumenophthalmus*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 196, 1883.
*Caranx plumieri*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IX, 65, 1833.
*Trachurops plumieri*, POEY, Enumeratio, 78, 1875.

## 418. HEMICARANX, Bleeker.

*Carangops*,* GILL, Proc. Ac. Nat. Sci. Phila., 1862, 431, (*falcatus*).
*Hemicaranx*,* BLEEKER, Versl. Kon. Ak. Wet., XIV, 134, 1862, (*marginatus*).

Maxillary very narrow, its greatest width scarcely ¼ eye; head small. Teeth uniserial, few or none on vomer or palatines. Dorsal and anal fins very low anteriorly, not falcate, their bases with a conspicuous sheath of scales. Lateral line more or less arched in front, the plates small and numerous. Tropical seas. Allied to *Caranx*, differing chiefly in the narrow maxillary. The American species are all rare and need further comparison. (*ἥμι*, half; *Caranx*.)

*a.* Arch of lateral line very strong, its height more than ⅓ its length; base of pectoral merely dusky; head very small; caudal lobes very unequal. AMBLYRHYNCHUS, 1305.
*aa.* Arch of lateral line less convex, its height not ⅓ its length;† caudal lobes subequal.
  *b.* Base of pectoral with a large jet-black area; sides in adult not barred; head small. ATRIMANUS, 1306.
  *bb.* Base of pectoral without black blotch; sides barred with black; head rather large.
    *c.* Head about 3½ in length; scutes of lateral line mostly armed.
      *d.* Soft dorsal with 30 rays; anal with 22. SECUNDUS, 1307.
      *dd.* Soft dorsal with 28 rays; anal with 24. FURTHII, 1308.
    *cc.* Head 3 in length; scutes feebly armed. LEUCURUS, 1309.

### 1305. HEMICARANX AMBLYRHYNCHUS (Cuvier & Valenciennes).

Head 4⅓; depth 2½; eye large, as long as snout, 3½ in head. D. VII–I, 28; A. II–I, 25; shields 50. Arch of lateral line very strong, its height more than ⅓ its length, which is much less than half length of straight part. Body oval, much compressed, with the axis nearly midway between the back and belly; profile very convex. Mouth very small, oblique, the maxillary reaching little past front of orbit. Head small, short. about as deep as long. Gill rakers shortish, rather strong, 20 below arch, anal spines small, the second longest; upper lobe of the caudal falcate, more than a third longer than the lower. Lateral scutes numerous, very strong. Teeth rather strong, in one series in each jaw; teeth on tongue few or none; those on vomer and palatines minute, deciduous; scales small; cheeks naked, breast scaly; lateral line strongly arched, the arch about ⅓ the straight portion; scaly sheaths of dorsal and anal very high, extending the whole length of fin. Pectoral falcate, little longer than head, reaching anal. Greenish above, with blue reflections; sides and below golden or dark silvery; caudal fin yellow, inner edge of upper lobe black; base of pectoral dusky; a black axillary spot; opercle faintly blotched. Tropical America from Cape Hatteras to Brazil; rather common in the West Indies, occasional on the coast of Carolina and Florida. (*ἀμβλύς*, blunt; *ῥύγχος*, snout.)

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* We have no means of knowing which of these two names has priority of date. Apparently *Hemicaranx* was first printed.

† Character not verified in *Hemicaranx secundus*.

*Caranx amblyrhynchus*, Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 100, pl. 248, 1833, Brazil; Günther, Cat., II, 441, 1860.

*Caranx falcatus*, Holbrook, Ichth. South Carolina, 94, 1860, Charleston.

*Caranx heteropygus*, Poey, Memorias, II, 344, 1861, Cuba.

*Carangops heteropygus*, Poey, Enumeratio, 77, 1875.

### 1306 HEMICARANX ATRIMANUS (Jordan & Gilbert).

Head 4; depth 2⅗. D. VI–I, 29; A. II–I, 25; scales 60 (all plates). Body regularly elliptical, compressed and much elevated, the dorsal and ventral curves about equal, and the greatest depth of body nearly in the middle of length, exclusive of caudal peduncle. Head small, short, and low, its depth rather less than its length, the upper profile descending gently to the sharp snout; jaws about equal; premaxillaries anteriorly about in the axis of body; maxillaries narrow, reaching slightly beyond anterior margin of orbit, 3⅔ in head; each jaw with a single regular series of very small, close-set teeth, without larger teeth; no teeth on vomer, palatines, or tongue. Eye moderate, slightly longer than snout, 1¼ in interorbital width; occiput with an evident carina. Gill rakers moderate, about 15 on the anterior limb, the longest half the diameter of orbit. Head naked, with the exception of a patch of scales on the temporal region. Distance from snout to origin of spinous dorsal less than length of pectorals; dorsal spines slender and fragile, the highest equaling distance from snout to front of pupil; a well-developed antrorse spine before dorsal; soft dorsal and anal similar, not falcate, the rays regularly decreasing from the first; highest soft ray of dorsal about half distance from snout to base of pectoral, and somewhat longer than the highest ray of anal; free anal spines little developed; dorsal and anal each depressible into a very high sheath of scales, which leaves only the last two or three rays uncovered; caudal fin wide, well forked, the upper lobe evidently longer and more falcate than the lower, but less produced than in *Hemicaranx amblyrhynchus*, the longest ray about ⅓ length of rest of fish; pectoral fin very long and falcate, reaching opposite to base of seventh ray of anal, about half longer than head; ventrals rather long, reaching beyond vent and slightly more than halfway to front of anal. Breast entirely covered with very fine thin scales; upper part of sides anteriorly with irregular series of scales which are not well imbricated; lateral line with a strong curve anteriorly (but less arched than in *Caranx amblyrhynchus*), the height of the curve ⅖ of its length, which is a little more than half length of straight portion; the line becoming abruptly straight opposite front of anal; plates of lateral line developed along entire length of straight portion, the plates not large, the height of the largest one not more than half diameter of eye. Color blackish olive above, dusky yellowish below with a silvery luster; top of head, snout, and a large diffuse blotch on upper part of opercle black; cheeks and lower parts of head thickly dusted with large brown points; vertical fins dusky, the caudal and anterior rays of anal with much greenish yellow; ventrals largely white; pectorals dusky olive, the axil and a large black blotch on both sides of the fin at base jet black, the blotch covering the base of all the rays of pectoral except the lower, and extending on the fin for a distance greater than ⅕ length of fin; inside of mouth and lining of opercles not black. Length 12 inches. A single specimen (Type, No. 29,341) was taken in the Bay of Panama. (*ater*, black; *manus*, hand.)

*Caranx atrimanus*, JORDAN & GILBERT, Bull. U. S. Fish Comm., I, 1881, 308, Panama.

### 1307. HEMICARANX SECUNDUS (Poey).

(SEGUNDO; VOLANTIN.)

Head 4¼ in total with caudal; depth 3. D. VII–I, 30; A. II, I, 22; eye 5 in head. Body oval, moderately elevated, the curve of the front a little greater than that of throat. Maxillary reaching first fourth of eye; adipose eyelid well developed; scales very small; pectoral long, falcate, the bucklers of lateral line beginning opposite its point, large and numerous; curve of lateral line not described. Caudal lobes not widely separated, probably subequal; dorsal and anal without salient lobe. Pale violet above, white below; sides with 6 broad dark bands, lost with age; fins mostly blackish, the caudal greenish; throat blackish. Cœca 20. Cuba; not very common, reaching a weight of 3 pounds; used as food. (Poey); not seen by us. (*secundus*, second, from the Spanish name *Segundo*. "J'ignore le motif qui l'a fait nommer ainsi."—Poey.)

*Caranx secundus*, POEY, Memorias, II, 223, 1860, Cuba. (Coll. Poey.)
*Carangops secundus*, POEY, Synopsis, 367, 1867.
? *Caranx fasciatus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IX, 70, 1833, Mexico; on a drawing by MOCIGNO & LESSÉ; a banded species, with angle of lateral line under front of soft dorsal.

### 1308. HEMICARANX FURTHII (Steindachner).

Head 3½; depth 2; eye 3⅘ in head. D. VIII–I, 28; A. II–I, 24; scutes 57. Body deep, strongly compressed, the back arched, the ventral line little curved. Maxillary reaching pupil. Dorsal and anal fins rather high, but the anterior rays not exserted beyond the rest; highest rays of dorsal, 1⅖ in length of head; sheath at base of dorsal little developed; caudal fin not deeply forked; pectoral moderate, as long as head, twice length of ventral; curve of lateral line not quite twice in straight part. Scutes small, but each ending in a spine. Teeth slender, rather long, uniserial above and below; no teeth on vomer or palatines. Body everywhere finely punctulate, with 6 rather sharply defined broad dark bars, besides one on the head; pectoral and caudal yellowish; other fins dark gray; axil with some dusky; caudal fin pale. Pacific coast of tropical America, known from three specimens, the largest 5 inches long, from Panama. (Steindachner.) Perhaps not distinct from *Caranx leucurus*. (Named for Ignatius Fürth, Austrian Consul at Panama.)

*Caranx fürthii*, STEINDACHNER, Ichth. Beitr., IV, 12, 1875, Panama. (Coll. Fürth.)

### 1309. HEMICARANX LEUCURUS (Günther).

Head 3; depth 2. D. VIII–I, 28; A. II–I, 24 to 26; scutes 50; snout rather obtuse, the jaws equal, the maxillary reaching past front of eye

Teeth uniserial, very small, none on palate. Lateral line with a semicircular arch, the length of which is $1\frac{2}{3}$ to $1\frac{4}{5}$ in straight part; its angle below front of second dorsal and with about 50 small low shields, but few of which have depressed spines. Pectoral reaching anal spines. Brownish gray, body with 6 dark-brown vertical bands, the first behind base of pectoral, the fourth from middle of soft dorsal; a large black spot on opercle; dorsal, anal, and ventral black; pectoral and caudal pale. Two specimens, each 3 inches long, from Panama. (Günther.) (λευκός, white; οὐρά, tail.)

*Caranx leucurus*, GÜNTHER, Proc. Zoöl. Soc. London, 1864, 24, Panama; (Coll. Capt. John M. Dow); GÜNTHER, Fish. Centr. Amer., 430, 1869; JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1883, 194.

## 419. CARANX,* Lacépède.

### (CREVALLÉS.)

*Caranx* (COMMERSON) LACÉPÈDE, Hist. Nat. Poiss., III, 57, 1802, (*trachurus*, *speciosus*, *carangus*, *ruber*, etc.).

*Caranx*, RAFINESQUE, Caratteri Alcuni Nuovi Generi, 41, 1810, (first restriction to *ferdau*, *ruber*, etc.).

*Tricropterus*, RAFINESQUE, Caratteri, 41, 1810,† (*carangus* = *hippos*).

*Carangus*, GRIFFITH, Cuvier's Nat. Hist. Fishes, 335, 1837, (based on *Les Carangues* of CUVIER; type *Caranx carangus*).

? *Argyrlepes*, SWAINSON, Class'n Fishes, II, 247, 1839, (*melanoptera*).

*Alepes*, SWAINSON, Class'n Fishes, 248, 1839, (*Wari parah*, RUSSELL = *nigripinnis*, DAY; species with the teeth uniserial on jaws and tongue only; body fusiform; shields numerous; dorsal low).

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[*] The proper type of the genus *Caranx* seems to be *Scomber ruber*, Bloch. The name *Caranx* was apparently recorded in manuscript by Commerson, who applied it to *Caranx speciosus*. In printed nomenclature *Caranx* was first used by Lacépède, who adopted the name from Commerson applying it to a large group containing among other species *trachurus*, *carangus*, *speciosus*, *ferdau*, and *ruber*. This genus was next further limited by Rafinesque in the following words:

"Io ho creduto dovere dividere in quattro generi, il genere *Caranx* dei moderni ittiologi che ho nominati *Trachurus*, *Caranx*, *Tricropterus*, e *Hypodis*; e questi tre ultimi non offeriscono veruno specie Siciliano; *Hipodys* (*Hypodis*) differisce dal *Trachurus* nell' avere due ale anali, e il *Caranx* nell' avere un raggio o spine sciolto fra le due ale dorsali ed il *Tricropterus* nell' averne tre forniti ognuno d'una membrana alare."

These characters are all partly fallacious and of no systematic importance. All of them are taken from Lacépède's analytical key. We must turn to Lacépède's work to find their significance. *Trachurus* evidently corresponds to Lacépède's "premier sous-genre," *Scomber trachurus* being its type. *Caranx* corresponds to the "second sous-genre," including the species *ferdau*, *ruber*, *gæz*, *sansun*, and *korab*. *Hypodis* (ὑπώ, below; δίς, two; two free anal spines or finlets) is based on *Scomber glaucus*, L. = *Lichia glauca*, Cuvier, a European species. *Tricropterus* is based on *Caranx carangua*, and is therefore synonymous with the later *Carangus* of Griffith and *Carangus* of Girard.

*Caranx* is next further restricted by Cuvier & Valenciennes. Among their "*Caranx* proprement dits" are two species, *ferdau* and *ruber*, placed in *Caranx* by both Rafinesque and Lacépède. One of these two species should apparently be retained as the type, unless we are to return to the manuscripts of Commerson for our understanding of the group. In Swainson's work, in 1839, *ruber* is still retained in connection with the name *Caranx*. As *trachurus*, *speciosus*, and *carangus*, species heretofore taken by authors as types of *Caranx*, are none of them available for this purpose because all of them were referred to other genera by Rafinesque, we must apparently choose between *ruber* and *ferdau*. We therefore select *Caranx ruber* as type of the genus.

Gill in 1862 adopted *speciosus* as the type of *Caranx* because this was the only species mentioned by Commerson, from whose manuscripts Lacépède adopted the name *Caranx*. It is not, however, evident that Lacépède regarded this species as his type. If, however, we should adopt this view, the name *Caranx* would supersede *Gnathanodon* and the genus here called *Caranx* would become *Tricropterus*. The name *Caranx* is really derived from *Carangue*, and several writers have taken *Caranx carangus* as its type. This arrangement seems to us not tenable. Its adoption would shift the names of the subgenera, *Caranx* taking the place of *Tricopterus*.

[†] *Hypodis*, Rafinesque, *l. c.* (based on *Scomber glaucus*, L.), is equivalent to *Lichia*, as is also Rafinesque's genus *Hypacantus*, *l. c.*, 43. *Lichia* is of later date.

*Selar*, BLEEKER, Verhandl. Batav. Genootsch., XXIV, 1851, (*boops*; teeth in one row; teeth on palate).

*Leioglossus*, BLEEKER, *l. c.*, (*carangoides*; teeth in one row; teeth on vomer and palatines, none on tongue).

*Uraspis*, BLEEKER, *l. c.*, (*carangoides*; teeth 2-rowed in jaws only).

*Leptaspis*, BLEEKER, *l. c.*, (*leptolepis*; uniserial teeth on lower jaw and tongue; none on upper jaw or palate).

*Selaroides*, BLEEKER, *l. c.*, (*leptolepis*).

*Carangichthys*, BLEEKER, Bijdragen Ichthyol. Fauna Celebes, III, 760, about 1852, (*typus*; young of some species allied to *latus*; preopercle serrate; teeth in several rows, outer enlarged; teeth on vomer, palatines, and tongue).

*Carangus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1858, 168, (*esculentus*=*hippos*).

*Paratractus*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 432, (*pisquetus*=*crysos*).

Body ovate or oblong, compressed, the back sometimes considerably elevated, sometimes little arched. Head moderate or rather large, more or less compressed. Mouth moderate or large, oblique; maxillary broad, with a well-developed supplemental bone, extending to below eye. Premaxillaries protractile. Teeth developed in one or few series, unequal, or at least not in villiform bands. Villiform teeth usually present on vomer, palatines, and tongue, wanting or deciduous in some species. Gill rakers long. Eye large, with an adipose eyelid. Dorsal spines rather low, connected; second dorsal long, usually elevated in front; both fins depressible in a groove. Anal fin similar to second dorsal and nearly as long, preceded by two rather strong spines, its base longer than the abdomen. Caudal fin strongly forked, the peduncle very slender. Ventral fins moderate; pectorals falcate; no finlets. Scales present, mostly very small. Lateral line with its posterior portion armed with strong bony plates, which grow larger on the tail, each plate armed with a spine; a short dorsal branch of lateral line usually present. Preopercle entire in the adult, serrate in the young, usually with a membranaceous border. Species very numerous in all warm seas, most of them valued for food. As here understood, this genus includes a considerable variety of forms, differing in the dentition and in the shape of the body. Its members seem, however, to form a natural series. (Name a corruption of the Portuguese *Acarauna*, French *Carangue*. Lacépède, however, claims to derive it from κάρα, head, "à cause de l'espèce de prominence que présente leur tête, de la force de cette partie, de l'éclat dont elle brille, et d'ailleurs pour annoncer la sorte de puissance et de domination que plusieurs osseux de ce genre exercent sur un grand nombre des poissons qui fréquentent les rivages."—Lacépède.)

*a.* Teeth on vomer and palatines persistent.

  *b.* Soft dorsal and anal low, not much elevated in front, little if at all falcate; teeth in jaws in one or few series, with no canines.

   SELAR:

    *c.* Lateral line strongly arched; arch of lateral line not half as long as straight portion; the angle under front of soft dorsal; breast scaly; lateral scutes strong, about 48 in number; scaly sheath of dorsal and anal very deep. Head 3½; depth 3; second D. I, 24; A. I, 19; sides with broad, dark bars; a black opercular spot; fins largely yellow. VINCTUS, 1310.

   CARANX:

    *cc.* Lateral line little arched, its curved part not shorter than its straight part; maxillaries scarcely reaching front of eye.

*d.* Opercular spot obsolete; body rather elongate, the depth 3 to 3½ in length; snout 3 in head; head 3⅓ in body; second D. I, 26; A. I, 22; shields 25 to 29.

*e.* Body slender, the depth about 3½ in length; color dark, chiefly bluish. RUBER, 1311.

*ee.* Body deeper, the depth about 2⅘ in length; color pale, mostly golden. BARTHOLOMÆI, 1312.

*bb.* Soft dorsal and anal much elevated in front and more or less falcate; upper teeth in a band, the outer enlarged; lower teeth in one series; dorsal sheath of scales not greatly developed; soft dorsal and anal both rather short.

TRICROPTERUS (τρεῖς, three; ἄκρον, point; πτερόν, fin; from the 3 free spines supposed to stand between the dorsals):

*f.* Breast naked, except a small rhombic area before ventrals; two small canines in front of lower jaw; body robust, compressed.

*g.* Opercular spot large; adult with a black spot on pectoral; pectoral 3 in length. Head 3¼; depth about 3; second D. I, 20; A. I, 16; scutes (developed) about 25. HIPPOS, 1313.

*ff.* Breast entirely covered with small scales.

PARATRACTUS (παρά, near; ἄτρακτος, spindle):

*h.* Body subfusiform, the depth less than ⅓ the length; breast scaly; teeth of outer series small, not canine-like; a black opercular spot; no spot on pectoral; arch of lateral line about half straight part. CRYSOS, 1314.

*i.* Pectoral fin moderate, rarely longer than head; scutes about 50.

*ii.* Pectoral fin very long, much longer than head; scutes about 40. CABALLUS, 1315.

CARANGICHTHYS, (*Caranx*; ἰχθύς, fish):

*hh.* Body oblong ovate, the depth more than ⅓ the length; outer teeth rather strong, lower teeth not canine-like.

*j.* General color silvery; vertical fins not all black.

*k.* Body moderately elevated, the depth in adult 2 to 2¾ in length. Opercular spot very small or obsolete; no pectoral spot; pectoral 3 in length.

*l.* Body rather elongate, the depth in adult 2¾ in length; dorsal and caudal fins largely black; eye larger than in *C. latus*, the head less obtuse. Head 3½; second D. I, 19; A. I, 15; scutes 30. MARGINATUS, 1316.

*ll.* Body moderately deep, the head bluntish, the eye small; the depth about 2½ in length; dorsal fin scarcely dusky, caudal fin pale. Head 3⅘; second D. I, 20; A. I, 17; scutes 30. LATUS, 1317.

*kk.* Body much elevated, the depth in adult 2⅕ in length; no dark cross bands nor opercular spot; a small, dark spot in axil; caudal and dorsal lobes dusky; curve of lateral line 1½ in straight part; caudal lobes as long as head; pectoral ⅕ longer. Head 3⅖; depth 2⅕; second D. I, 22; A. II, I, 19; scutes 32. MEDUSICOLA, 1318.

*jj.* General color brassy or blackish; vertical fins black; lower teeth not canine-like.

*m.* Anterior profile gibbous; head very large; curve of lateral line less than ⅔ straight part; second dorsal and anal strongly falcate; anterior lobe of dorsal about ⅔ head; pectoral very long, 2¾ in length; color nearly uniform black. Head 3⅓; depth 2⅖; second D. I, 21; A. II, I, 18; scutes 28. LUGUBRIS, 1319.

*mm.* Anterior profile scarcely gibbous; curve of lateral line a little more than ⅔ straight part; soft dorsal and anal strongly falcate; anterior rays of dorsal ⅔ head; pectoral a little more than ⅓ body; color dark olivaceous or brassy; sides with many small dark-brown spots. Head 3⅓; depth 2¾; second D. I, 22; A. I, 19; scutes about 35. MELAMPYGUS, 1320.

URASPIS (*οὐρά*, tail; *ἀσπίς*, shield):

*aa.* Teeth on vomer and palatines wanting or deciduous; teeth in jaw subequal, bluntish, in one or two rows; lateral line not strongly arched; soft dorsal and anal low; shields rather few.

*n.* Body deep, compressed, the back and belly arched; shields 24 to 30; second D. I, 26; A. I, 22; opercular spot present. GUARA, 1321.

### Subgenus SELAR, Bleeker.

### 1310. CARANX VINCTUS, Jordan & Gilbert.

(COCINERA.)

Head 3½; depth 3. Second D. I, 24; A. I, 19; lateral scutes strong, about 48. Body elongate, elliptical, compressed, upper profile evenly arched from snout to caudal peduncle, the lower nearly rectilinear from snout to origin of anal fin; upper profile slightly carinate anteriorly. Width of cheek about equal to diameter of eye. Mouth moderately oblique, the jaws subequal, the lower scarcely included; intermaxillaries anteriorly about on a level with axis of body, just below level of lower margin of eye; maxillary reaching vertical from front of orbit, 3 in head; teeth very small, blunt, in a narrow band in each jaw, becoming a single series in sides of mandible; the outer series slightly enlarged; teeth on vomer, palatines, and tongue similar to those on jaws. Gill rakers very long, numerous, the longest ⅔ diameter of orbit, their number about 10 + 27. Eye large, less than length of snout, about equaling interorbital width, 4 in head. Adipose eyelid moderately developed. Preopercle with its posterior margin very oblique, the angle broadly rounded; preorbital thin, its least width ⅗ diameter of orbit. Spinous dorsal well developed, the spines high and flexible; the antrorse spine well developed; the fourth spine the longest, the fifth but little shorter; those posterior rapidly decreasing; the fourth spine equaling ⅖ length of head; length of longest dorsal ray less than ½ length of head; anal spines strong, the soft rays a little lower than those of dorsal; soft dorsal and anal entirely received within a very deep membranaceous scaly sheath, which is ⅖ the height of median dorsal rays, and terminating before the ends of the fins, leaving the last 2 rays free; the 2 fins not falcate, the rays regularly decreased from first; pectorals very long, falcate, reaching much beyond origin of anal, and to twelfth lateral scute; the fins ⅓ length of body; ventrals reaching to or slightly beyond vent, which is nearly equidistant from their inner axil and from second anal spine; caudal lobes not falcate, the upper slightly the longer, a little less than length of head. Lateral line with a strong curve anteriorly, the width of which is less than ½ straight portion; the depth of curve about ¼ its width; plates very strongly developed, extending the whole length of straight portion of lateral line, which begins under first dorsal rays; top of head, opercles, jaws, and preorbital scaleless or with a very few scattering scales; cheeks scaly; breast entirely covered with fine scales; membrane of caudal fin with series of scales. Color dusky, bluish above, silvery below, with golden and greenish reflections; 8 or 9 vertical dark half bars descend from back to below lateral line, the widest about equaling diameter of orbit, and more than twice as wide as the light interspaces; breast blackish; head dusky; end of snout black; a distinct black blotch on upper angle of opercle; fins somewhat dusky; the lower yellow in life; pectoral without spot; axil dusky; anal white at tip of lobe. Pacific Coast of Mexico, Mazatlan to Punta Arenas. A well-marked species, abundant about the entrance to the Gulf of California, its range extending thence to the coast of Central America. (*vinctus*, banded.)

*Caranx vinctus*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1881, 349, Mazatlan; (Type, Nos. 28365 and 28366. Coll. Gilbert); Jordan & Gilbert, Proc. U. S. Nat. Mus., 1883, 197.

*Caranx*, sp., Lay & Bennett, Beechey's Voyage, 55, 1849, San Blas; Mazatlan.

### Subgenus CARANX.

### 1311. CARANX RUBER (Bloch).

(Cibi Mancho; Carbonero.)

Head $3\frac{2}{5}$; depth $3\frac{1}{2}$. D. VII–I, 26; A. II, I, 22; scutes 25 to 29. Straight portion of lateral line considerably longer than curved part, $2\frac{1}{4}$ in body. Lateral line not strongly arched; maxillary scarcely reaching front of eye; teeth on vomer and palatines persistent, those on jaws in a few series without canines. Dorsal low, its anterior rays slightly falcate, $2\frac{1}{3}$ in head. Color bluish olive, silvery below, scarcely yellowish in life; a vaguely defined horizontal stripe of clear blue just below the dorsal; dorsal yellowish gray, other fins dusky olive, a distinct blackish bar extending along lower lobe of caudal. West Indies; not rare. (*ruber*, red, which the species is not; it was originally named from a drawing erroneously colored.)

*Scomber ruber*, Bloch, Ichthyologia, plate 342, 1793, Ste. Croix.

*Caranx ruber*, Bloch & Schneider, Syst. Ichthyol., 29, 1801; Jordan & Gilbert, Proc. U. S. Nat. Mus., 1884, 32; Günther, Cat., II, 430.

*Caranx blochii*, Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 69, 1833, Ste. Croix; same type.

*Caranx iridinus*, Poey, Memorias, II, 226, 1860, Cuba.

*Carangoides iridinus*, Poey, Synopsis, 366, 1868; Poey, Enumeratio, 77, 1875.

### 1312. CARANX BARTHOLOMÆI, Cuvier & Valenciennes.

(Yellow Jack; Cibi Amarillo.)

Head $3\frac{1}{5}$; depth $2\frac{4}{5}$. D. VIII–I, 27; A. II–I, 23; scales 28. Body ovate, deep and compressed, somewhat elliptical; the profile anteriorly not elevated, forming an even curve continuous from the snout to the base of the dorsal the snout therefore not blunt. Top of head not much compressed. Premaxillaries on the level of the lower edge of the pupil; maxillary not reaching to opposite the front of the pupil. Teeth rather small, in a narrow band on each jaw, without distinct canines; villiform teeth on tongue, vomer, and palatines. Cheek about as deep as the eye, which is rather small, considerably shorter than snout; adipose eyelid little developed. Gill rakers long. Breast entirely scaly; soft parts of the vertical fins densely covered with small scales. Dorsal low, its anterior rays slightly falcate. Pectoral fin falcate, a little shorter than the head, reaching past the front of the anal; caudal equally forked. Straight part of lateral line 2⅕ in body, scarcely as long as curved part; plates of lateral line small. In life, bluish silvery, everywhere strongly washed with golden, the young with golden spots. Fins all pale yellow; no black on opercle or lower lobe of caudal. West Indies, occasionally northward to Florida and North Carolina; common in Cuba. (Named for the Island of San Bartolomé.)

*Caranx bartholomæi*, Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 100, 1833, St. Bartholomew; Jordan & Gilbert, Synopsis, 436, 1833.

*Caranx cibi*, Poey, Memorias, II, 224, 1860, Cuba.

*Caranx beani*, Jordan, Proc. U. S. Nat. Mus., 1880, 486, Beaufort, North Carolina. (Type, No. 27372. Coll. Gilbert.)

*Carangoides cibi*, Poey, Synopsis, 366, 1867.

### Subgenus TRICROPTERUS, Rafinesque.

### 1313. CARANX HIPPOS (Linnæus).

(Crevallé; Toro; Horse Crevallé; Cavally; Jack; Jiguagua.)

Head 3½; depth 2½; lateral line (scutes) about 30. D. VIII–I, 20; A. II–I, 17. Body oblong, the anterior profile very strongly arched. Head large and deep. Mouth large, low; lower jaw prominent; maxillary extending to nearly opposite posterior border of eye, 2⅛ in head. Teeth in upper jaw in a broad villiform band; an outer series of large, wide-set, conical teeth; teeth of lower jaw in one row, a distinct canine on each side of symphysis; villiform teeth on vomer, palatines, pterygoids, and tongue. Lateral line with a wide arch, its length 1⅛ in straight part, the angle under fifth dorsal ray; plates not covering all of straight part. Dorsal spines short, rather stout; gill rakers stout, ràther long, 15 below angle. Occipital keel sharp. Eye not very large. Pectoral falcate, ⅕ longer than head. Breast naked, with only a small triangular patch of scales in front of ventrals. Caudal lobes equal, nearly as long as head. Olivaceous above; sides and below golden; a large distinct black blotch on opercle, bordered behind with pale; a large faint black spot on lower rays of pectorals, the latter sometimes wanting in young; axil of pectoral with a black blotch; edge of soft dorsal black; upper edge of caudal peduncle dusky. Warm seas, generally abundant; found on both coasts of tropical America, north to Cape Cod and Gulf of California, also in the East Indies; a large and well-known food-fish. More abundant northward on our coast than any other species of the genus except *Caranx crysos*. Easily distinguished by its canines, its naked breast, and the color markings. (ἵππος, horse.)

*Scomber hippos*, Linnæus, Syst. Nat., Ed. XII, 494, 1766, Charleston, South Carolina.

*Scomber carangus*, Bloch, Ichthyol., pl. 340, 1793, Antilles.

*Caranx erythrurus*, Lacépède, Hist. Nat. Poiss., III, 68, 1802, South Carolina; based on *Scomber hippos*, Linnæus.

*Caranx daubentonii*, Lacépède, Hist. Nat. Poiss., III, 72, 1802, Martinique; on a drawing by Plumier.

*Caranx carangua*, Lacépède, Hist. Nat. Poiss., III, 59, 74, 1802, Martinique; on a drawing by Plumier; Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 91, 1833; Günther, Cat., II, 448, 1860, and of authors.

*Caranx xanthopygus*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 109, 1833, Isle de France.
*Caranx ekala*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 117, 1833, Vizagapatam; after *Ekala parah*, of Russell.
*Caranx antillarum*, Bennett, Whaling Voyage, ii, 282, 1840, West Indies.
*Caranx defensor*, De Kay, N. Y. Fauna: Fishes, 120, 1842, New York; Holbrook, Ichth. South Carolina, 87, 1860.
*Carangus esculentus*, Girard, U. S. Mex. Bound. Surv., 23, pl. xi, figs. 1-3, 1859, Brazos Santiago, Texas. (Coll. Würdemann.)
*Carangus chrysos*, Gill, Proc. Ac. Nat. Sci. Phila., 434, 1862; young.
*Caranx caninus*, Günther, Fish. Centr. Amer., 432, 1869, Panama.
*Carangus hippos*, Gill, Proc. Ac. Nat. Sci. Phila., 1862, 433, and elsewhere; Poey, Enumeratio, 75, 1875.
*Caranx hippus*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 269; Jordan & Gilbert, Synopsis, 437; Jordan & Gilbert, Proc. U. S. Nat. Mus., 1883, 200.

### Subgenus PARATRACTUS, Gill.

### 1314. CARANX CRYSOS (Mitchill).

(Hard Tail; Runner; Jurel; Yellow Mackerel; Crévalle.)

Head 3¾; depth 3¼. D. VIII-I, 24; A. II-I, 19; lateral line 50 (scutes). Body oblong, moderately elevated, the dorsal and ventral outlines about equally arched. Profile forming a uniform curve. Snout rather sharp. Mouth slightly oblique, a little below axis of body. Maxillary reaching about to middle of orbit. Teeth comparatively large; a single series in lower jaw; upper jaw with an inner series of smaller teeth; no canines; teeth on vomer, palatines, and tongue. Eye rather small, shorter than snout, 3½ in head. Gill rakers long and numerous. Pectoral as long as head, barely reaching anal; rarely longer than head in certain specimens from Key West, possibly referable to *C. caballus*. Scales moderate; cheeks and breast scaly. Lateral line with a weak arch anteriorly, which is about half length of straight portion. Lateral scutes numerous, developed on whole straight part of lateral line. Greenish olive, golden yellow or silvery below; a black blotch on opercle; fins all pale. Length 1 foot or more. Cape Cod to Brazil; generally abundant, common farther north than any of the other species of *Caranx*; a well-known food-fish rarely exceeding a foot in length, not found in the Pacific, where it is replaced by *Caranx caballus*. (χρυσός, gold.)

*Scomber crysos*, Mitchill, Trans. Lit. & Phil. Soc. N. Y., i, 1815, 424, New York.
*Caranx pisquetus*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 97, 1833, San Domingo, Cuba, and Brazil; Jordan & Gilbert, Synopsis, 435, 1883.
*Trachurus squamosus*, Gronow, Cat. Fishes, Ed. Gray, 125, 1854, Carolina.
*Caranx crysos*, De Kay, N. Y. Fauna: Fishes, 121, 1842; Günther, Cat., ii, 445, 1860.
*Paratractus pisquetus*, Gill, Proc. Ac. Nat. Sci. Phila., 1862, 432; Poey, Synopsis, 336, 1868.
*Caranx chrysus*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1883, 190; Jordan & Gilbert, Synopsis, 970, 1883.

### 1315. CARANX CABALLUS (Günther).

(Cocinero; Cocinero Dorado; Jurel.)

Head 4; depth 3⅓. D. VIII-I, 24 (22 to 24); A. II-I, 21 (20 or 21); lateral line 41 (developed scutes). Pectoral usually longer and scutes fewer than in *Caranx crysos*. Form of *C. crysos*; rather elongate, not greatly compressed; the dorsal and ventral outlines regularly and nearly equally arched; a low occipital carina; a prominent supraocular ridge. Scales comparatively large, the scaly sheaths of the vertical fins moderately developed. Cheeks and upper part of opercles scaled; breast scaly. Teeth in a narrow band above, those in front somewhat enlarged, those of lower jaw mostly in one series; feeble teeth on tongue, vomer, and palatines. Mouth rather small, the jaws nearly equal; maxillary reaching front of pupil, 2⅔ in head. Eye large, 3½ in head, the adipose eyelid well developed. Gill rakers numerous, very long and slender, 28 below angle. Curve of lateral line low, the straight part beginning under first ray of second dorsal; length of arch 1⅔ in straight part. Scutes of lateral line strong. Pectoral fins very long, slender, and falcate, their length considerably more than that of the head, 2¾ in length of body, their tips reaching fourth anal ray; ventrals short; second dorsal and anal a little elevated in front, the longest ray half length of head, the last rays of the fin scarcely rising above the scaly sheath. Greenish above, golden below; a black blotch on the opercle, no spots elsewhere; fins greenish, with faint dusky shades, nowhere distinctly black. Pacific Coast of tropical America, Cerros Island to Panama, straying northward to San Diego; very common from Guaymas southward. Closely related to *C. crysos*, of which it is a representative on the Pacific Coast. Among our specimens of *Caranx crysos* from Key West, are some which agree closely with the type of *Caranx caballus*, having the pectoral scarcely shorter; it is not likely that the two forms can be distinguished as species, and perhaps not even as varieties. (*caballus*, horse; the names Caballo and Horse-mackerel are often applied to species of *Caranx*.)

*Trachurus boops*, GIRARD, Pac. R. R. Surv., Fish., 108, 1858, San Diego; not *Caranx boops*, CUVIER & VALENCIENNES.

*Caranx caballus*,* GÜNTHER, Fish. Centr. Amer., 431, 1869, Panama; JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1880, 456; JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1883, 199; JORDAN & GILBERT, Synopsis, 435, 1883.

*Caranx girardi*,* STEINDACHNER, Ichthyol. Notizen, IX, 25, 1869, San Diego; based on *Trachurus boops*, GIRARD.

*Caranx boops*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 261.

### Subgenus CARANGICHTHYS, Bleeker.

### 1316. CARANX MARGINATUS, Gill.

Head 3½; depth 2⅔; eye 3. D. VIII–I, 19; A. II–I, 15; scutes 30. Body more elongate than in *Caranx latus*, the back less elevated, and the profile less steep. Eye larger, 3½ in the young of *C. latus* of same size. Teeth moderate, the anterior in both jaws little enlarged; maxillary 2 in head, reaching beyond pupil; teeth and mouth essentially as in *Caranx latus*. Gill rakers rather long, about 12 below angle; scutes rather weaker than in *C. latus*; arch of lateral line 1⅓ in straight part, an abrupt angle at junction of the two parts which is under sixth dorsal ray; pectoral ⅕ longer than head; cheeks and upper parts of opercle scaly;

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*We do not know which of these two names of the same date is entitled to priority. Günther's paper was written first and probably printed first.

breast scaly; scaly sheath of fins little developed. Bluish; sides golden; a very small, black opercular spot and a black axillary spot; young sometimes with faint cross bands; fins all deep golden, especially the anal; dorsal and caudal broadly margined with black, the color covering most of fin; no spot on pectoral. Pacific Coast of Mexico; rather common at Mazatlan; recorded from Mazatlan and Panama; long confounded with *Caranx latus*, which lives in the same waters. *Caranx marginatus* is readily known by the slenderer form, dark colors, and larger eye. (*marginatus*, edged.)

*Caranx marginatus*, Gill, Proc. Ac. Nat. Sci. Phila., 1866, 166, Panama. (Coll. Capt. Dow.)

### 1317. CARANX LATUS, Agassiz.

(Jurel; Xurel; Horse-eye Jack.)

Head 3⅖; depth 2½. D. VIII–I, 22; A. II–I, 16 to 18; lateral line with 35 scutes. Form of *Caranx hippos*, but the profile not so strongly arched. Teeth much as in *C. hippos*, the canines considerably weaker. Gill rakers rather long, about 12 below angle. Breast scaly. Scutes present on whole of straight part of lateral line; arched part of lateral line 1⅓ in straight part; an abrupt angle at junction of the two parts, which is under third dorsal ray. Pectoral about as long as head; maxillary reach; ing posterior edge of pupil; cheek and upper parts of opercles scaly - scaly sheaths of fins little developed. Bluish; sides golden or silvery; a very small, black opercular spot; young sometimes with faint dark cross bands; fins mostly grayish. Anterior part of soft dorsal fin dusky; caudal yellow, without black; no spot on pectorals; no axillary spot. West Indies and all warm seas, occasionally north to Virginia; very abundant southward; not so common northward as *Caranx hippos*. Equally abundant on the west coast of Mexico; our specimens from Panama, Clarion Island, and Chatham Island apparently not different from West Indian examples. Also common in the East Indies, if *Caranx heberi* is the same, as we suppose. The flesh is sometimes poisonous in the tropics, giving rise to the disease called Ciguatera. (*latus*, broad.)

*Caranx latus*, Agassiz, Pisc. Bras., 105, 1829, Brazil; Jordan & Gilbert, Proc. U. S. Nat. Mus., 1883, 200.

*Caranx lepturus*, Agassiz, Pisc. Bras., 106, 1829, Brazil; Günther, Cat., ii, 447.

*Scomber heberi*, Bennett, Fishes Ceylon, pl. 26, 1830, Ceylon.

*Caranx fallax*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 95, 1833, Antilles; Brazil; Poey, Repertorio, 328, 1875; Jordan & Gilbert, Synopsis, 437, 1883.

*Carangus fallax*, Gill, Proc. Ac. Nat. Sci. Phila., 1862, 433, and elsewhere; Poey, Synopsis, 364, 1868.

*Caranx sem*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 105, 1833, Pondicherry.

*Caranx forsteri*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 107, 1833, East Indies.

*Caranx peroni*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 112, 1833, East Indies.

*Caranx lessoni*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 113, 1833, Malabar.

*Caranx belengeri*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 116, 1833, Malabar.

*Caranx paraspistes*, Richardson, Voy. Erebus and Terror, 136, 1844, Port Essington.

*Caranx hippos*, Günther, Cat., ii, 449, 1860, not *Scomber hippos* L.; Günther, Fishes Centr. Amer., 431, 1869; Day, Fishes of Malabar, 86, 1865; Günther, Fische der Südsee, 131, fig. 84, 1876.

*Caranx richardi*, Holbrook, Ichthyol. South Carolina, 96, pl. 13, fig. 1, 1860, South Carolina.

*Caranx aureus*,* Poey, Enumeratio, 76, 1875, Cuba.

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* *Caranx aureus*, Poey. Brilliant yellow; silvery below; ventrals straw color; anal yellow; tip of second dorsal and caudal lobes greenish. Length 10 inches. Seen in Cuba after north winds in winter. Said to differ from *Caranx latus* only in color.—(Poey.)

### 1318. CARANX MEDUSICOLA, Jordan & Starks.

Head 3⅖; depth 2⅕. D. VII–I, 22; A. II–I, 19 or 18; scutes 32. Pectoral ⅙ longer than head. Dorsal lobe 1⅔ in head; caudal lobes equal to head; curve of lateral line 1½ in straight part; height of arch in its chord 4. Eye 4 in head; snout 3; maxillary 3; ventral 2⅓. Body unusually deep and compressed, deeper than in *Caranx latus*; the back elevated, the belly similarly arched; head moderate, deep, the nape arched. Mouth small, maxillary broad, with broad supplemental bone. Teeth in moderate bands, the outer enlarged but not canine-like; upper teeth rather larger than lower and in a broader band. Villiform bands on vomer, palatines, and tongue. Eye moderate; preorbital rather narrow. Gill rakers rather long and slender, about 12 below angle of arch. Soft dorsal and anal with falcate lobes. Caudal well forked, the lobes equal. Pectoral very long and falcate; ventrals short. Lateral line rather strongly curved, with moderate armature. Breast entirely scaly. Clear blue above, silvery below; no bands or spots anywhere, except a small, black axillary spot, and a blue-green patch on back of caudal peduncle; pectoral bright yellow; anal and caudal yellow, the lobes blackish; caudal grayish, the lobes black with whitish posterior edge; ventrals yellow; young with a deep-blue spot above the eye in life. Length 6 to 12 inches. About Mazatlan, on sandy shores; very common; the young of an inch in length very abundant in the body cavity of a large translucent jelly-fish found about the Venados Islands in January. (*Medusa*, a jelly-fish; *colo*, to inhabit.)

*Caranx medusicola*, Jordan & Starks, Rept. Fishes Sinaloa, MS., 1895, Mazatlan. (Coll. Hopkins Expedition.)

### 1319. CARANX LUGUBRIS, Poey.

(Tiñosa.)

Head 3⅓; depth 2⅖; eye 4½. D. VII–I, 21; A. II–I, 18. Body oblong ovate, compressed, deep, the back elevated, but not arched. Profile gibbous from occiput forward to above eye, thence straight and steep at a considerable angle to a point in front of nostrils, whence the snout again projects at a strong angle. Outline of back nearly straight from occiput to front of second dorsal, thence declining regularly to caudal peduncle. Ventral outline nearly straight from lower jaw to origin of anal, the base of which is placed at a similar angle to that of soft dorsal. Head large, very deep, deeper than long, occipital ridge not sharp. Mouth large, the broad maxillary reaching to opposite front of pupil. Lower jaw strong, the chin projecting when mouth is closed. Teeth in upper jaw in a narrow villiform band, with an outer series of larger, conical teeth, 6 to 8 in number on each side, subequal and regularly arranged. Lower jaw with a single series of teeth similar to the larger teeth of upper jaw, a few smaller teeth intermixed with them. No differentiated canine teeth. Villiform teeth on vomer, palatines, and tongue. Gill rakers rather long, close-set, ⅗ diameter of eye. Eye large, with a distinct adipose eyelid, its diameter equal to that of the broad preorbital, which is wider than maxillary.

Cheeks closely scaled; opercles mostly naked below; a few scales on subopercle and interopercle. Scales on body not very small; breast closely scaled. Lateral line with a moderate curve anteriorly, becoming straight at front of anal, the length of the arch being less than ⅔ that of straight part; greatest depth of arch about ⅕ its length. Armature of lateral line beginning at the curve; the plates rather large, very broad, 28 in number. Fins with very few scales or none. Spinous dorsal moderate, the spines rather strong, its last spine stout and free, nearly horizontal. Second dorsal falcate, the longest rays more than half length of its base. Posterior part of fin rather low, rising well above its low basal sheath of scales which terminates near middle of fin; anal similar to soft dorsal, its anterior rays more than half base of fin. Free anal spines moderate. Caudal lobes rather broad, equal, not very long, the upper as long as from snout to edge of opercle, depth of fin from tip to tip about equal to depth of head. Ventral fins short, not filamentous, as long as from snout to end of maxillary. Pectoral extremely long, falcate, reaching to tenth plate of lateral line, or about to seventh anal ray, its length 2¾ in that of body, less than greatest depth of body. Color sooty blackish, nearly uniform, the belly not paler than back. A black spot at angle of opercle, none on pectoral. Ventrals, anal, and dorsal wholly black, as are the shields of lateral line. Length 18 inches. Rocky islands in the tropics, both in the Atlantic and Pacific. We have compared our specimens from Clarion Island, Revillagigedos, with one of Poey's specimens from Cuba, and with specimens obtained by Dr. Streets. These differ somewhat in form and in the height of fins, but we have no doubt that all belong to the same species, this being another of those common to the two coasts of tropical America. The species is rather common about Cuba, where it is regarded as poisonous, and its sale in the markets is forbidden. (*lugubris*, mournful, from its dark color and especially its bad reputation, associated with the dread Ciguatera, a disease arising from fish poisoning.)

*Scomber ascensionis*, Bloch & Schneider, Syst. Ichth., 33, 1801; not *Scomber ascensionis* of Osbeck, which may be *Caranx guara*.

*Caranx lugubris*, Poey, Memorias, II, 222, 1860, Cuba; Jordan & Gilbert, Proc. U. S. Nat. Mus., 1881, 227; Jordan & Gilbert, Proc. U. S. Nat. Mus., 1883, 201.

*Caranx frontalis*, Poey, Memorias, II, 222, 1860, Cuba.

*Caranx ascensionis*, Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 102, 1833; Günther, Cat., II, 432, 1860; Günther, Fische Südsee, XI, 132, pl. 85, 1876; Günther, Voy. Challenger, Shore Fishes, 4, 5, 1880.

*Carangus lugubris*, Poey, Synopsis, 365, 1868.

### 1320. CARANX MELAMPYGUS, Cuvier & Valenciennes.

Head 3½; depth 2¾; eye 2 in length of snout, 1¼ in depth of broad preorbital, 2½ in postorbital part of head, and 2 in interorbital area. Second D. I, 22; A. I, 19; scutes about 35. Body oblong ovate, compressed, the back arched, the profile not steep, the curve from snout to dorsal being a nearly regular arc; ventral outline nearly straight from the chin to front of anal, where an angle is formed with the ascending base of the anal. Head moderate, compressed, not blunt in profile, the occiput and interorbital region elevated and considerably carinated. Mouth moderate, low, oblique, the lower jaw prominent, scarcely projecting beyond upper; maxillary barely reaching to opposite front of small eye. Upper jaw with a band of villiform teeth, in front of which is a row of strong teeth, about 10 on each side, the anterior largest, larger than in most species, but hardly canines. Lower jaw with a single row of rather large teeth, irregularly placed much smaller than the larger teeth of the upper jaw; villiform teeth on vomer, palatines, and tongue. Eye small, placed high and far back; adipose eyelid small. Cheeks and upper part of opercles with small scales; rest of head naked. Gill rakers long and strong, as long as eye. Scales rather small; breast closely scaled; lateral line not strongly arched, becoming straight opposite front of anal, its curved part 1⅖ in length of straight part. Plates on anterior portion of straight part scarcely different from ordinary scales; those on posterior portion moderate, with high keels and appressed spines; 37 plates in all, counting from beginning of straight part. Spinous dorsal moderate, the spines slender, rather high. Procumbent spine obsolete. Soft dorsal low, falcate in front, the longest ray little more than half base of fin, or 1½ in length of head. Anterior part of fin with a distinct scaly basal sheath, which becomes obsolete at about the fourteenth ray. Anal fin similar to soft dorsal, a little shorter and lower, its scaly sheath more developed; free anal spines moderate. Caudal fin widely forked, its lobes subequal, 1⅓ in head, distance from tip to tip more than length of either lobe. Pectorals long and falcate, their tips reaching sixth anal ray, longer than head, and a trifle less than greatest depth of body. Ventrals short, ⅓ length of pectorals. Coloration in spirits olivaceous; dark above; pale below, but nowhere silvery; top of head clear olivaceous; opercular spot obsolete; lower jaw soiled golden; no pectoral spot; base of pectoral somewhat dusky; small irregular dark-brown spots, smaller than the pupil and irregular in size, scattered without order over the body, rather most numerous about pectorals. Caudal fin dusky, especially on its posterior edge; dorsal and anal dusky, their lobes black; ventrals dusky at tip; pectorals olivaceous. Pacific Ocean, about islands in mid-ocean, widely distributed. Our specimen from Socorro Island of the Revillagigedo group. (μέλας, black; πυγή, rump.)

*Caranx melampygus*, Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 116, 1833, East Indies. Günther, Cat., II, 440, 1860; Günther, Fische der Südsee, 133, pl. 86, 1876; Streets, Bull; U. S. Nat. Mus., VII, 69, 1877; Jordan & Gilbert, Proc. U. S. Nat. Mus., 1881, 230; Jordan & Gilbert, Proc. U. S. Nat. Mus., 1883, 201.

*Caranx stellatus*, Eydoux & Souleyet, Voy. Bonite, Poiss., 167, 1840, Hawaiian Islands.

*Caranx bixanthopterus*, Rüppell, Neue Wirbelthiere, 49, 1837, Red Sea.

### Subgenus URASPIS, Bleeker.

### 1321. CARANX GUARA (Bonnaterre).

("Enxaréo.")

Head 3⅓; depth 2½; snout 2½ in head; eye 4⅗ to 5¼. D. VII–I, 26; A. II–I, 21. Shields 24 to 29, 112 scales in lateral line. Body oval, compressed, the outlines evenly curved; head compressed; upper profile steep, not strongly decurved; mouth small, the broad maxillary barely reaching front of eye; teeth in jaws biserial in young, uniserial in adult, the teeth subequal, blunt; villiform teeth on vomer, palatines, and tongue in the young, these disappearing entirely with age, traces remaining in specimens of 13 inches; lips thick in the adult. Lateral line little arched, its curved part rather longer than its straight part. Pectoral long, falcate, reaching seventh soft ray of anal, slightly longer than head. Soft dorsal and anal low, scarcely elevated in front, the rays 2⅔ to 3 in head. Caudal lobes long, as long as head. Bluish and silvery; a black opercular spot; no spots on fins. Length 2 feet. (Steindachner.) Tropical parts of the Atlantic, widely distributed; not rare in the Mediterranean; common along the coasts of Africa, Brazil, and the Madeiras. Not certainly known from the West Indies, though doubtless occurring there. It is also abundant in the South Pacific, if *Caranx platessa* and *Caranx chilensis* are really the same species, as is supposed. We have not studied this species and are not sure of all its synonymy. (*Guara Tereba*, a Brazilian name used by Marcgrave for some *Caranx*, apparently *Caranx latus*.) (Eu.)

? *Scomber adscensionis*, Osbeck, Iter China, 1757 and 1771, English edition, Ascension Island; soft D. 25; A. 25. Gray above; sides silvery. Length 1 foot. May be *crumenophthalmus* or *ruber*; not *Scomber ascensionis*, Forster, 1801, nor *Caranx ascensionis*, Cuvier & Valenciennes, which is *C. lugubris*.

*Scomber guara*, Bonnaterre, Encycl., 1788, 139, pl. 58; on a specimen from America in Jussieu's collection.

*Scomber dentex*, Bloch & Schneider, Syst. Ichth., 30, 1801, Brazil.

*Caranx dentex*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 87, 1833; Günther, Cat., ii, 441, 1860, erroneously ascribed to New Orleans; Steindachner, Ichth. Berichte, v, 36, pl. 1, 1868; Jordan & Gilbert, Proc. U. S. Nat. Mus., 1883, 198.

? *Trachurus imperialis*, Rafinesque, Caratteri, 42, 1810, Palermo.

*Caranx luna*, Geoffroy St.-Hilaire, Descr. Egypte Poiss., pl. 23, about 1820, Egypt.

*Citula banksi*, Risso, Eur. Mérid., iii, 422, 1826, Nice.

? *Caranx platessa*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 84, 1833, seas of the Indies.

? *Caranx georgianus*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 85, 1833, Australia.

*Caranx solea*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 86, 1833, Brazil.

*Caranx analis*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 88, 1833.

? *Caranx chilensis*, Gay, Hist. Chili, Zoöl., ii, 250, 1850, Juan Fernandez.

## 420. GNATHANODON,* Bleeker.

*Gnathanodon*, Bleeker, Verh. Batav. Genootsch., xxiv, Makreele, 1851, (*speciosus*; teeth on tongue only, none on jaws or palate).

*Caranx*, Gill, Proc. Ac. Nat. Sci. Phila., 1862, 433, (*speciosus*; not *Caranx*, as restricted by Bleeker).

*Hypocaranx*, Klunzinger, Fische des Rothen Meeres, 92, 1884, (*speciosus*).

This genus differs from *Caranx* mainly in the dentition, the teeth being very small, granular, and entirely lost with age. The maxillary is broad, the body compressed, and the fins are without filaments. Tropical seas. (*γνάθος*, jaw; *ἀ*, without; *ὀδούς*, tooth.)

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*Should the name *Caranx* be regarded as limited to the species (*speciosus*) first placed in it in the manuscripts of Commerson, the present genus would be called *Caranx*, rather than *Gnathanodon*.

### 1322. GNATHANODON SPECIOSUS (Forskål).

(Mojarra Dorada.)

Head 3⅙; depth 2⅓ to 2. Second D. I, 20; A. I, 16; scutes weak, about 15. Teeth very minute, disappearing early; none on vomer or palatines; cheeks scaly; breast entirely scaly. Curve of lateral line 1⅓ in straight part. Body broadly ovate, strongly compressed; vertical fins somewhat falcate; the lobe of the soft dorsal about half head; pectoral falcate, ⅙ longer than head. Gill rakers numerous, long, about 20 below angle. Color brilliant golden, with 6 broad, dusky cross bands, a narrow stripe between each pair of broad ones; opercular spot obsolete, a small black axillary spot; caudal lobes with dusky inner edge; no dark spots on caudal in young or old. Length 2 feet. Tropical parts of the Pacific and Indian oceans, Cape San Lucas to the Red Sea; on sandy shores; an excellent and valued food-fish. The three dark blotches on the caudal fin described and figured by authors as characteristic of *G. speciosus* are not found in our specimens. (*speciosus*, beautiful.)

*Scomber speciosus*, Forsål, Descr. Anim., 1775, xii, Red Sea, at Djidda, Arabia.
*Scomber rim*, Forskål, *l. c.*, 1775, 54, Djidda.
*Caranx poloosoo*, Richardson, Voy. Erebus & Terror, Ichth., pl. 58, fig. 4 and 5, 1844; called *Caranx speciosus* in text; Australia.
*Caranx speciosus*, Günther, Cat., ii, 444, 1860; Günther, Fish. Centr. Amer., 431, 1869; Jordan & Gilrebt, Proc. U. S. Nat. Mus., 1882, 375; *ibid*, 1883, 202
*Caranx panamensis*, Gill, Proc. Ac. Nat. Sci. Phila., 1863, 166, Panama.

## 421. CARANGOIDES, Bleeker.

*Carangoides*, Bleeker, Batav. Genootsch. Verh., xxiv, Makreele, 1851, (*plagiotænia*; teeth equal several series in both jaws and on palate and tongue).

Teeth persistent, all small, in villiform bands on jaws, vomer, palatines, and tongue. Lateral line scarcely arched in front. Body oblong, not much elevated; none of the dorsal rays produced. Otherwise essentially as in *Caranx*. Tropical seas. (*Caranx*; εἶδος, likeness.)

### 1323. CARANGOIDES ORTHOGRAMMUS (Jordan & Gilbert).

Head 2¾; depth 3⅔; eye large, broader than preorbital, its diameter 1½ in length of snout, 4⅔ in head. Second D. I, 32; A. I, 26; scutes 17. Body elliptical, compressed, the back regularly but not strongly arched, the ventral outline forming a rather even but less convex curve. Head longer than deep, rather pointed in profile, its median ridge somewhat elevated. Mouth low, oblique, the maxillary extending to nearly opposite front of pupil, its length 2⅓ in head; lower jaw slightly projecting. Teeth all equally minute, in villiform bands on jaws, vomer, palatines, and tongue. Adipose eyelid little developed. Cheeks and temporal region with fine scales; rest of head naked. Scales rather small, those below pectorals smaller; a naked area on breast, becoming wider forward from base of ventrals. Lateral line almost straight, slightly undulated and curved upward above pectorals, becoming straight by almost imperceptible degrees opposite lobe of anal. Greatest depth of the arch less than diameter of pupil; the length of straight part less than that of the curve. Plates developed only on the posterior third of the straight part; the plates small, with low keels, their spines little prominent; 15 to 18 plates developed, including small ones, in front of which are about 40 ordinary scales on the straight portion of the lateral line. Spinous dorsal very small, of 3 weak spines slightly connected by membrane, the highest spine not longer than diameter of pupil (these spines, probably, more numerous and larger in young examples). Soft dorsal long and low, with slender rays; a well-developed scaly basal sheath anteriorly. Elevated rays in front a little more than ½ the base of the fin, a little more than half length of head; anal shorter than dorsal, its anterior lobe equally high, and with a similar basal sheath. Free anal spines obsolete in typical specimen. Caudal lobes moderate, equal, as long as head, their length equal to the depth of the fin from tip to tip. Pectoral fin falcate, its tip very slender, reaching eighth ray of anal, its length 2½ in body. Ventrals short, 2½ in head. Coloration in spirits, smutty olivaceous, everywhere irregularly clouded with darker, the belly scarcely paler than the back; opercular spot obsolete. Dorsal, anal, posterior border of caudal, and tips of ventrals blackish; fins otherwise dull olivaceous. Length 16 inches. Revillagigedo Islands; one specimen known; the species is possibly identical with the one called *Caranx ferdau* by Günther (Fische der Südsee, 134, 1876), from the Pacific islands. It is, however, certainly different from the original *Scomber ferdau* of Forskål, from the Red Sea. (ὀρθός, straight; γραμμή, line.)

*Caranx orthogrammus*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 226, 1881, Sulphur Bay, Clarion Island, Revillagigedos. (Type, No. 28345. Coll. Lieut. Nichols.)
*Carangoides orthogrammus*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 202, 1883.

## 422. CITULA, Cuvier.

*Citula*, CUVIER, Règne Animal, Ed. I, 315, 1817, (*armata*).
*Atropus*, CUVIER, Règne Animal, Ed. I, 1817, 324, (*atropus*).

This genus differs from *Carangoides* mainly in having one or more of the anterior rays of the soft dorsal produced in filaments. The body has not the distorted form seen in *Alectis*, but is more like that of *Caranx*. The young is more like *Caranx* in form and appearance than the adult,* its

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*Compared with the central species of *Caranx* (as *Caranx latus*), *Citula dorsalis* differs strikingly in many respects, among others the following: The greater compression and elevation of the body, the greater length and sharpness of the breast, the much greater depth of the preorbital region, the greater prominence and sharpness of the frontal and occipital keel, the more oblique position of the bones of the head, the feebleness and uniformity of the teeth, the approximation below of the mandibular rami, the reduction in size of the scales and scutes, and the increase of the naked areas, the reduction or loss (in the adult) of the dorsal and anal spines, the increase in length of the lobes of the dorsal, anal, and caudal, and, finally, the increase in the difference between the old and the young. Not one of these features is, however, well adapted for generic distinction, as they increase by easy transitions from species to species. On the other hand, comparing *Citula dorsalis* with *Selene vomer*, we find that in almost every one of the differences above noted, the latter species carries these characters to a still greater extreme, and differs from *Citula dorsalis* in just the respects in which the latter differs from *Caranx latus*. *Vomer setipinnis* is, in some regards, a species still more extreme than *Selene vomer*, although it has not quite lost the lateral scutes. As a matter of fact the *Caranginæ* (excepting *Megalaspis*, *Decapterus*, and possibly *Trachurus*) form a continuous, almost unbroken series, only divisible into genera for convenience sake, beginning with *Trachurus* on the one hand and ending with *Selene* on the other.

later development carrying the fish farther in the direction of the extreme forms *Alectis, Hynnis,* and *Selene.* Warm seas. (*Citula,* an Italian name of *Zeus faber.*)

### 1324. CITULA DORSALIS* (Gill).

(PÀMPANO.)

Head 3⅕; depth 2 1/10. D. VI–I, 19; A. II, I, 17; eye 4¾ in head; snout 2⅔. Pectorals ⅕ longer than head; ventrals short, 3 in head; dorsal lobes 1⅔ in body reaching middle of caudal. About 25 developed scutes. Caudal lobe equal to head. Dorsal with 1 long filament, anal with 1. Caudal moderate, the lobes equal. Dorsal sheath of scales very low. Pectoral very long, falcate, reaching tenth anal ray. Ventrals small, reaching just past vent. Body deep, compressed, rather ovate than angular, profile straight from the vertically truncate snout to nape, then rounded, then straight to front of dorsal. A nearly straight line from chin to front of anal. Eye rather small; adipose eyelid small; preorbital deep; mouth rather large, the lower jaw included; teeth small, in broad bands on jaws, vomer, and palatines; maxillary reaching pupil, 2½ in head. Cheek entirely scaly, some scales on opercle above; breast naked, body well scaled; a partly naked area above lateral line; body with small scales, the nuchal region naked, scarcely carinate. Gill rakers rather long, 2 + 15. Lateral line evenly curved, the curve high, equal to straight part. Scutes small, 18 with keels, the total number of scales on straight part 58. Steel blue above, silvery below, with golden reflections and shades; fins all pale, tinged with yellowish, some of the posterior membranes of dorsal dusky; no black on pectorals; axis jet black; ventrals tipped with dusky. Opercle with a dusky streak along its edge; blackish within; a dark spot on orbit above. Young more elongate, the produced rays shorter. Length about 1 to 2 feet. Pacific Coast of Mexico, not rare on sandy shores in the surf, Mazatlan to Panama. (*dorsalis,* pertaining to the back.)

*Carangoides dorsalis,* GILL, Proc. Ac. Nat. Sci. Phila., 1863, 166, Panama; not *Vomer dorsalis,* GILL.

*Caranx dorsalis,* GÜNTHER, Fish. Centr. Amer., 432, 1869.

*Citula dorsalis,* JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 375.

*Caranx otrynter,* JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1883, 202; a new name as a substitute for *dorsalis,* preoccupied in *Caranx,* if *Vomer dorsalis* is regarded as a species of *Caranx.*

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*A large specimen from Mazatlan apparently represents the adult condition of this species. Its characters are: Head 3½; depth 2¼. Second D. I, 18; A. I, 17; about 25 scutes developed. Body rather elongate, moderately compressed, with angular outlines. Profile of head rounded; that of belly somewhat concave, forming an angle at front of anal similar to that at front of dorsal. Eye 5 in head; maxillary 2½; mouth moderate; lower jaw included. Teeth in broad, villiform bands on both jaws and on vomer and palatines. Nostrils large, equal, close together. Gill rakers 3 + 14, rather stout, shorter than eye. Dorsal spines all obsolete in specimens examined. First dorsal ray soft, filamentous, 1¾ in body; longest anal ray 2¾ in body. Caudal keel considerably elevated, with a small keel above and below it; scutes not sharp; caudal lobes subequal, about as long as head; pectorals falcate, ⅓ longer than head; ventrals short, 3⅔ in head. Curve of lateral line low, 1⅛ times in straight part, its height ¼ the length of its chord. Maxillary broad, with very broad supplemental bone, its greatest width ⅔ eye. Color silvery, strongly tinged with golden. olive on upper parts, with pearly reflections below; a large black spot in axil, nearly as large as eye. Fins all pale. A single large specimen, 2 feet in length, taken in the Astillero at Mazatlan.

## 423. ALECTIS, Rafinesque.

(THREADFISHES.)

*Gallus*, LACÉPÈDE, Hist. Nat. Poiss., IV, 583, 1802, (*virescens*; name preoccupied in birds).
*Alectis*, RAFINESQUE, Analyse de la Nature, 1815, (substitute for *Gallus*, preoccupied).
*Blepharis*, CUVIER, Règne Anim., II, 322, 1817, (*ciliaris*; name preoccupied).
*Scyris*, CUVIER, Règne Anim., Ed. II, Vol. II, 209, 1829, (*indica*).
*Gallichthys*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IX, 168, 1833, (*gallus*; substitute for *Gallus*).
*Blepharichthys*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 431, (*ciliaris*; substitute for *Blepharis*, preoccupied).

Body rhomboid, deep, strongly compressed, more or less completely covered with minute embedded scales, sometimes apparently naked; scutes on the straight portion of the lateral line enlarged, bony, and spinous, as in *Caranx*, but much less developed. Mouth moderate, with bands of villiform teeth on jaws, vomer, palatines, and tongue. First dorsal fin little developed, the spines short and rudimentary, mostly disappearing with age; soft dorsal and anal similar to each other; the first five or six rays of each fin elongate and filiform in the young, becoming shorter with age; ventral fins elongate in young, short in the adult; pectorals falcate; no finlets. Caudal peduncle narrow, the caudal widely forked. Gill rakers moderate, stout. This genus is not essentially different from *Caranx*, the great change in form arising from no important modification of the skeleton. The changes due to age are surprisingly great, as Dr. Lütken has shown, the characters of the nominal genera being chiefly stages in the growth of individuals. The young individuals are almost orbicular in form, with the filaments excessively long. Tropical seas. (ἀλέκτωρ, a cock; different species having been known as *Meerhenne* or *Gallus marinus*, *Peixe-Gallo*, *Gal*, or *Poisson-Coq*; these names first applied to *Zeus faber*.)

### 1525. ALECTIS CILIARIS (Bloch).

(THREADFISH; COBBLER FISH; SUNFISH.)

Head 3⅓; depth 1¼ to 2. D. VI–I, 19; A. II–I, 16; scutes 12. Body oval, much compressed, highest at the elevated bases of dorsal and anal fins. Preorbital very deep. Mouth nearly horizontal in the adult, very oblique in the young. First rays of dorsal and anal filamentous, exceedingly long, in the young much longer than body, becoming shorter with age. Lateral line with a wide arch, the curved portion about equal to the straight part. Scaly sheath of fins little developed. Scutes becoming stronger and blunter with age. Ventrals broad; occipital keel sharp. Pectorals long and falcate, longer than head. Bluish above, golden yellow below; a dark blotch on opercle; a black spot on orbit above; a black blotch on dorsal and anal in front. Tropical America on both coasts, ranging north to Cape Cod and Mazatlan, generally common southward, about the Florida Keys and Cuba; a food-fish of some importance. The many nominal species of this type have been reduced by Lütken to three or four: *gallus* and *ciliaris* of the East Indies, *alexandrinus* of North Africa, and *crinitus* of America. We have not examined the East Indian forms, but we see no reason for doubting that *ciliaris* is the young of *gallus*, as has been supposed by Dr. Day and others. The name *gallus* was, however, originally applied by Linnæus to *Selene vomer*. Our young specimens of *crinitus*, moreover, agree fully with the figures of *ciliaris*. We think it, therefore, extremely probable that all the nominal species of this type are forms of *Alectis ciliaris*. As has been shown by Lütken (Spolia Atlantica, 197), the nominal genera *Scyris*, *Blepharis*, and *Gallichthys*, are simply stages in the development of individuals, the characters assigned to these genera changing with age. (*ciliaris*, with long lashes.)

*Zeus ciliaris*, Bloch, Ichthyol., vi, 29, pl. 29, 1788, **East Indies**; young.
*Scomber filamentosus*, Mungo Park, Trans. Linn. Soc., iii, 36, 1797, **Sumatra.**
*Gallus virescens*, Lacépède, Hist. Nat. Poiss., iv, 583, 1803; after Linnæus.
*Zeus crinitus*, Mitchill, Amer. Journ. Sci. Arts, xi, 1826, 144, **Shoreham.**
*Blepharis crinitus*, De Kay, N. Y. Fauna: Fishes, 123, 1842.
*Alectis crinitus*, Jordan & Gilbert, Synopsis, 438, 1883.
*Blepharichthys crinitus*, Gill, Proc. Ac. Nat. Sci. Phila., 1862, 262.
*Caranx crinitus*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 359; *ibid* 1883, 203.
*Gallichthys crinitus*, Lütken, Spolia Atlantica, 131, 197, 1880.
*Blepharis sutor*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 161, 1833, **Caribbean Sea.**
*Caranx sutor*, Günther, Cat., ii, 454, 1860.
*Blepharis major*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 163, 1833, **West Indies.**
*Gallichthys chevola*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 175, 1833, **East Indies.**
*Carangoides blepharis*, Bleeker, Verhand. Batav. Genootsch., xxiv, Makr. 67, 1852, **East Indies.**
*Carangoides gallichthys*, Bleeker, *l. c.*, 68, **East Indies.**
*Scyris analis*, Poey, Synopsis, 369, 1868, **Cuba**; a large specimen without filamentous rays on the anterior part of the anal; probably an accidental variation; the dorsal has the second ray as long as the body; the other filamentous rays shorter. A. I, 14.

## 424. HYNNIS, Cuvier.

*Hynnis*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 195, 1833, (*gorcensis*).

This genus has the high, compressed, angular body of *Selene*, the dorsal and anal lobes not ending in filaments, and the caudal peduncle armed with a few weak plates, as in *Alectis*. Its position is between *Alectis* and *Selene*, with close affinities to both. As elsewhere stated, the separation of these peculiarly formed genera from *Caranx* and from each other has no basis in any structural character of importance. Tropical seas. (*ὕννις*, a vomer or plowshare.)

*a.* Eye moderate, 5½ in head in adult; pectorals pale. CUBENSIS, 1326.
*aa.* Eye very large, 3¾ in head in adult; pectorals tipped with dusky. HOPKINSI, 1327.

### 1326. HYNNIS CUBENSIS (Poey).

Head 4 in total length with caudal (about 3⅓ without); depth 3 (2½ without). D. I, 19; A. I, 16. Eye 5½ in head in specimen of 2½ feet. Maxillary reaching nostrils. Teeth villiform, present on jaws, vomer, and palatines. Scales minute. Arch of lateral line very convex, its scutes weak. Pectorals falciform, a little longer than head. Insertion of anal opposite second third of pectoral. Dorsal moderately falcate, its height ⅖ that of body below it. Caudal deeply forked. Silvery, with bright reflections; a large blue spot on opercle; lips bluish; no spot on pectoral. Length 3 feet. Cuba. (Poey.) We have examined Poey's drawings of this species and are sure that it is distinct from *Hynnis alexandrinus*, the Egyptian species.

*Hynnis cubensis*, POEY, Memorias, II, 235, 1860, Havana. (Coll. Poey.)

### 1327. HYNNIS HOPKINSI, Jordan & Starks.

(PÁMPANO.)

Head 3½; depth 2; eye 3⅚. D. VI–I, 18; A. II, I, 15; snout 2¾ in head; maxillary 2¾; pectoral 3⅕ in body; V. 2¼ in head; dorsal lobes 2⅕ in head; caudal lobes 1⅖; anal 2¼; preorbital 4¼ in head. Body oblong, compressed, elevated, with angular outlines, ventral outline sharp. Top of head sharply carinate; profile nearly straight from snout to nape, there boldly convex, then nearly straight to elevated front of soft dorsal, a concavity in profile before soft dorsal and before anal. Mouth oblique, rather large, the jaws equal. Broad bands of small sharp teeth on jaws, vomer, and palatines. Eye very large. Dorsal and anal lobes low, none of the rays prolonged. Lateral line with a long arch, as long as straight part, which has about 12 elevated scutes and 37 scales in all from end of curve; curved part of lateral line undulating behind. Gill rakers short, rather few, 12 in all, those above angle obsolete. Body minutely scaly. Belly and lower parts largely naked, a large patch of scales on cheeks; head otherwise naked. Pectoral long, falcate, reaching seventh anal ray; ventrals not short, reaching past vent. Caudal moderate. Bright blue above, with bright reflections; sides bright silvery; no golden; a narrow brownish streak not quite so wide as pupil from upper part of gill opening to middle of base of soft dorsal; pectoral tipped with black; axil of pectoral dusky; upper fins rather dusky, lower white; dusky on angle of opercle inside and out, but without definite spot. One specimen, 26 inches long, taken with a seine in the surf at Puerto Viejo, near Mazatlan. (Named for Timothy Hopkins, esq., of San Francisco, founder of the Hopkins Laboratory on Monterey Bay, in recognition of his deep interest in biological research.)

*Hynnis hopkinsi*, JORDAN & STARKS, Rept. Fishes Sinaloa, MS., 1895, Mazatlan. (Type, No. 1563, L. S. Jr. Univ. Mus. Coll. Hopkins Expedition.)

## 425. VOMER, Cuvier and Valenciennes.

*Vomer*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IX, 189, 1833, (*brownii*).
*Platysomus*, SWAINSON, Class'n Fishes, II, 250, 1839, (*brownii*).

This genus is closely allied to *Caranx*, from which it differs only in its distortion of form, and in its weak teeth and very low fins. Body broad ovate, very strongly compressed, all the outlines sharply trenchant. Head very gibbous above the eyes, its anterior profile vertical; lateral line strongly arched, its posterior portion with very weak shields. Scales minute, rudimentary; soft dorsal and anal extremely low, not falcate. Young much deeper in form than the adult, all the fins higher, resembling *Selene*. Warm seas. (*vomer*, a plowshare, from the form of the body.)

*a.* Soft dorsal with about 25 rays; depth in adult less than half length. DORSALIS, 1328.
*aa.* Soft dorsal with 21 or 22 rays.
  *b.* Depth in adult about half length. SETIPINNIS, 1329.
  *bb.* Depth in adult much more than half length. GABONENSIS, 1330.

### 1328. VOMER DORSALIS, Gill.

Depth less than half length of body. D. VII–I, 25; A. I, 20. West Indies and west coast of Africa. (Günther.) A doubtful species, not seen by us. (*dorsalis*, pertaining to the dorsal, which is longer than in *Vomer setipinnis*.)

*Argyreiosus setipinnis*, var. B, GÜNTHER, Cat., II, 459, 1860, St. Vincent, Cape Verde Islands; West Indies.
*Vomer dorsalis*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 436; after GÜNTHER.
*Vomer senegalensis*, GUICHENOT, Ann. Soc. Linn. Maine et Loire, 1865, 35, Senegal.
*Vomer goreensis*, GUICHENOT, *l. c.*, 37, Gorea.
*Caranx setipinnis dorsalis*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1883, 204.

### 1329. VOMER SETIPINNIS (Mitchill).

(JOROBADO; MOONFISH; HORSEFISH; BLUNT-NOSED SHINER.)

Head 3¼; depth 2 in adult, 1¼ to 1¾ in young. D. VIII–I, 21 or 22; A. II–I, 19 or 20; scutes 20. Body oblong, rhombic, less elevated than in *Selene vomer*; profile anteriorly nearly vertical, highest above the eye, snout somewhat protruding, belly mostly arched in the young; mouth oblique; maxillary reaching vertical from front of orbit. Ventral fins minute; dorsal and anal very low, especially in the adult, the long rays disappearing very early; pectorals falcate, about as long as head. Greenish above, below golden or silvery. Young with a black blotch at origin of straight part of lateral line. Tropical America, on both coasts; from Maine to Brazil, and Cape San Lucas to Peru; generally common southward, the young coming northward in the Gulf Stream; also in Western Africa. (*seta*, bristle; *pinna*, fin.)

*Zeus setipinnis*, MITCHILL, Trans. Lit. and Philos. Soc. N. Y., 1815, 384, New York.
*Vomer browni*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IX, 189, plate 256, 1833, New York and West Indies.
*Argyreiosus setipinnis*, GÜNTHER, Cat., II, 459, 1860.
*Vomer setipinnis*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 436; JORDAN & GILBERT, Synopsis, 440, 1883; JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1883, 204.
*Selene setipinnis*, LÜTKEN, Spolia Atlantica, 135, 1880.
*Platysomus spixii*, SWAINSON, Class'n Fishes, II, 1839, 250, 406, Brazil; after SPIX and AGASSIZ, pl. 57.
*Platysomus micropteryx*, SWAINSON, *l. c.*, 406, Pernambuco.
*Argyreiosus unimaculatus*, BATCHELDER, Proc. Bost. Soc. Nat. Hist., II, 1845, 78, Maine; young.
*Vomer sanctæ-marthæ*, *columbianus*, *martinicensis*, *dominicensis*, *noveboracensis*, *sanctæ-petri*, *brasiliensis*, *cayennensis*, and *cubæ*, GUICHENOT, Ann. Soc. Linn. Maine et Loire, 1865, 38 to 44, localities indicated by the names.
*Vomer curtus*, COPE, Proc. Amer. Philos. Soc. Phila., 1870, 119, Rhode Island; young.

### 1330. VOMER GABONENSIS, Guichenot.

Depth in adult more than half length. D. VIII–I, 22; A. I, 18 or 19. West Indies and west coast of Africa (Günther). A doubtful species, not seen by us.

*Argyreiosus setipinnis*, var. A., GÜNTHER, Cat., II, 459, 1860, **Fernando Po; San Domingo; Jamaica; Bahia.**
*Vomer gabonensis*, GUICHENOT, Ann. Soc. Linn. Maine et Loire, 1865, 42, **Gaboon.**
*Argyreiosus gabonensis*, STEINDACHNER, Fisch-Fauna des Senegals, 38, 1869.
*Caranx setipinnis gabonensis*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1883, 204.

## 426. SELENE, Lacépède.

### (MOONFISHES.)

*Selene*, LACÉPÈDE, Hist. Nat. Poiss., IV, 560, 1803, (*argentea* = young of *vomer*).
*Argyreiosus*, LACÉPÈDE, Hist. Nat. Poiss., IV, 566, 1803, (*vomer*).

Body very closely compressed and much elevated, the profile very oblique or nearly vertical; edges of body everywhere trenchant, especially anteriorly. Head short and very deep, the opercle very short, and the preorbital extremely deep; an abrupt angle at the occipital region. Mouth rather small; premaxillaries protractile, fitting into a notch between the bases of the maxillaries; maxillaries broad, each with a supplemental bone. Tongue narrow, free. Teeth minute, on jaws, tongue, vomer, and palatines. Gill rakers long and slender. Spines of fins usually weak, more or less filamentous in the young; free anal spines immovable, sometimes obsolete in the adult. Soft fins falcate, much elevated. No finlets. Head naked. Scales minute. Lateral line wholly unarmed. Coloration silvery. Tropical seas. Notwithstanding its extraordinary form, this genus differs in no important regard from *Caranx*. (σελήνη, the moon.)

*a.* Dorsal with about 18 soft rays, anal with about 15; anterior profile of head curved; bones of head lower and less oblique than in *Selene vomer*. ŒRSTEDII, 1331.
*aa.* Dorsal with about 23 soft rays, anal with about 18; anterior profile of head, from base of snout to occiput, almost perfectly straight. VOMER, 1332.

### 1331. SELENE ŒRSTEDII, Lütken.

Head 3; depth 2. D. VI–I, 15; A. (II)–I, 14; eye 4 in head; snout 1¾; maxillary 2¾; ventral 3⅓; caudal lobes equal head; pectoral ⅛ longer than head. Body compressed and elevated, but less so than in *Selene vomer*; profile oblique, concave over snout, then straight to occiput, which is well rounded; line of back straight to soft dorsal, then slightly curved to caudal peduncle; ventral outline rounded on breast to ventrals, then straight to anal, forming an angle at first ray, then straight to caudal peduncle. Mouth projecting, with minute teeth on jaws, vomer, palatines, and tongue; gill rakers thick and blunt, many of them knobbed at tip—in old examples at least, 1 above angle with 3 or 4 rudimentary ones, and 13 below. A large thickened knob at occiput, very conspicuous in adult, due to the thickening of the supraoccipital crest. Pectoral falcate, reaching to tenth anal ray; dorsal and anal lobes filamentous, reaching past tips of caudal lobes; lateral line strongly arched, its curve equal to its straight part. Color silvery, with bluish reflections above; dorsal and caudal dark, pectoral, ventral, and anal white; axil dusky. Length 15 inches. Pacific Coast of tropical America, from Mazatlan to

Panama; not common. Here described from an adult example taken at Mazatlan. (Named for Professor Ørsted of Copenhagen, its discoverer.)

*Selene ørstedii*, Lütken, Spolia Atlantica, 144, 1880, Punta Arenas.

*Selene œrstedii*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1883, 205.

### 1332. SELENE VOMER (Linnæus).

(Moonfish; Jorobado; Look Down; Horsehead.)

Head 3; long dorsal rays 2; pectoral 2¾; long anal rays 2⅔; depth 1½, the young much deeper. D. VII-I, 23;[*] A. II-I, 18. Anterior profile from tip of snout to occiput almost perfectly straight in the adult. Diameter of eye, length of opercle, and distance from eye to profile about equal; eye 2 in maxillary, 2½ in preorbital; mandibles very deep, the dentary bones thin, approximate; one or two of the dorsal spines greatly elongate and filamentous in the young, short in the adult; ventrals variable in length, usually about as long as the eye in the adult, variously elongate in partly grown specimens. Color uniform silvery in the adult. Our observations of this species tend to confirm the correctness of Dr. Lütken's views (Spolia Atlantica, 139) as to the transformations incident to its growth. Tropical America, on both coasts, from Cape Cod to Brazil, and from Lower California to Peru. Very common southward on sandy shores, both in the Atlantic and Pacific. The Pacific Coast form, *brevoortii*=*pacificus*, is not evidently different from *Selene vomer*. (*vomer*, a plowshare.)

*Zeus vomer*, Linnæus, Syst. Nat., Ed. x, 1758, 266, America; after *Zeus cauda bifurca* of Linnæus, Mus. Adolph-Fred., i, 66.

*Argyreiosus vomer*, Lacépède, Hist. Nat. Poiss., iv, 566, 1803; Gill, Proc. Ac. Nat. Sci. Phila., 1862, 437, and elsewhere.

*Selene vomer*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 177, 1833; Günther, Cat., ii, 458, 1860; Lütken, Spolia Atlantica, 1880, 547, (with figures showing the various changes undergone with age); Jordan & Gilbert, Synopsis, 439, 1883; Brevoort, Ann. Lyc. Nat. Hist. N. Y., v, 68, pl. 4, 1853; Gill, Proc. Ac. Nat. Sci. Phila., 1862, 436; Jordan & Gilbert, Proc. U. S. Nat. Mus., 1883, 205.

*Zeus gallus*, Linnæus, Syst. Nat., Ed. x, 1758, 267, America; after *Zeus cauda bifurca* of Artedi; confused with *Alectis ciliaris*.

*Zeus niger*, Bloch & Schneider, Syst. Ichth., 98, 1801, (confounded with *Pomacanthus arcuatus*).

*Selene argentea*, Lacépède, Hist. Nat. Poiss., iv, 560, pl. 9, fig. 2, 1803, (adult).

*Zeus capillaris*, Mitchill, Trans. Lit. & Phil. Soc., 1, 1815, 383, (young), New York.

*Argyriosis capillaris*, Gill, Proc. Ac. Nat. Sci. Phila., 1862, 437.

*Zeus rostratus*, Mitchill, *l. c.*, 384, New York, (young).

*Zeus geometricus*, Mitchill, Amer. Monthly Mag., ii, 1818, 245 (adult), New York.

*Argyriosus triacanthus*, Swainson, Nat. Hist. Class'n Fish., 1839, 250, Brazil; after Spix & Agassiz, pl. 58, (young).

*Argyriosus filamentosus*, Swainson, *l. c.*, 250; after Cuvier & Valenciennes, pl. 255.

*Argyriosus setifer*, Swainson, *l. c.*, 409; after Cuvier & Valenciennes, pl. 255, substitute for *vomer* and *filamentosus*.

*Argyriosus mauricei*, Swainson, *l. c.*, 408, Brazil, (adult).

*Argyriosus mitchilli*, De Kay, N. Y. Fauna: Fishes, 1842, 126, (young), New York.

*Argyriosus spixii*, Castelnau, Anim. Nouv. Rares, 23, 1855, (adult).

*Argyriosus brevoorti*, Gill, Proc. Ac. Nat. Sci. Phila., 1863, 83, Panama, (young).

*Argyreiosus pacificus*, Lockington, Proc. Ac. Nat. Sci. Phila., 1876, 84, Lower California, (adult).

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[*] D. I, 20 to 22; A. I, 17 or 18, in Pacific Coast specimens = *Selene brevoortii* (Gill).

## 427. CHLOROSCOMBRUS, Girard.

(CASABES.)

*Chloroscombrus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1858, 168, (*cosmopolita*).
*Micropteryx*, GÜNTHER, and others, but *Micropteryx*, AGASSIZ, was given as a substitute for *Seriola*, of which name it must be considered a synonym.

Body oblong ovate, closely compressed, but not elevated; the abdomen prominent anteriorly, its curve being much greater than the curve of the back. Occiput and thoracic region trenchant. Caudal peduncle very narrow, the fin widely forked. Scales small, smooth. Lateral line arched in front, unarmed, or with a few small plates. Head nearly naked. Preorbital low. Mouth rather small, oblique, lower jaw scarcely projecting; upper jaw protractile; maxillary broad, emarginate behind, with a large supplemental bone. Jaws, vomer, and palatines with feeble teeth, mostly in single series. First dorsal of feeble spines, connected by membrane; second dorsal and anal long and low, similar, much longer than the short abdomen. No finlets. Anal spines strong. Ventrals small; pectorals falcate. Gill rakers long. American; small species, little valued as food. (*χλωρός*, green; *σκόμβρος*, mackerel.)

*a.* Chord of curved part of lateral line considerably longer than head, $1\frac{1}{3}$ to $1\frac{3}{7}$ in straight part; lateral line armed posteriorly with small bony shields, as in *Vomer*; coloration rather dusky, the fins largely tipped or edged with blackish. ORQUETA, 1333.

*aa.* Chord of curved part of lateral line about as long as head, measured from tip of lower jaw, and $1\frac{2}{3}$ to $1\frac{3}{4}$ in length of straight part; lateral shields wholly obsolete; coloration rather pale. CHRYSURUS, 1334.

### 1333. CHLOROSCOMBRUS ORQUETA, Jordan & Gilbert.

(ORQUETA; XUREL DE CASTILLA.)

Head $3\frac{3}{4}$; depth $2\frac{1}{3}$. D. VIII–I, 26; A. II, 26. Body ovate, strongly compressed, the edges trenchant. Dorsal and ventral outlines very regularly curved, the curve of the belly considerably stronger than that of the back, the axis of body much nearer the latter. Caudal peduncle very slender. Young less elongate than the adult, otherwise very similar in form. Head small, rather pointed, the anterior profile nearly straight. Mouth small, very oblique, the lower jaw projecting. Maxillary broad, extending a little beyond front of eye, its length $2\frac{3}{4}$ in head, its tip marginate; supplemental bone well developed. Teeth very small, those of the jaws not villiform, forming very narrow bands or single series in both jaws; villiform patches on vomer, palatines, and tongue. Adipose eyelid well developed. Preorbital very narrow, not half width of orbit. Gill rakers numerous, very long, slender, close-set. Head nearly naked. Body covered with well-developed imbricated scales; the ventral ridge, and a narrowly triangular area forward from front of dorsal naked. Lateral line with a rather strong arch anteriorly, the chord of the curve being considerably longer than head, and $1\frac{1}{3}$ to $1\frac{3}{7}$ in the straight part. (In *Chloroscombrus chrysurus* the chord of the curve is about as long as head from tip of lower jaw, and $1\frac{2}{3}$ to $1\frac{3}{4}$ in the straight portion.) A distinct keel along caudal peduncle, the scales of lateral line enlarged and bony, with bluntish tips. (In *C. chrysurus* the scales of lateral line are little if at all different from the other scales.) Dorsal and anal naked, the sheaths at their bases largely developed along the anterior half of each fin. Antrorse dorsal spine concealed. Spinous dorsal persistent, the spines slender, longest slightly shorter than anterior rays of soft dorsal, which are about half head. Soft dorsal and anal with anterior rays highest, the fins not falcate. Caudal widely forked, the upper lobe slightly longer than the lower, which about equals head. Anal spines strong. Pectorals very long, falcate, a little more than ⅓ length. Ventrals short, about ⅖ head. Color somewhat darker than in *C. chrysurus*. In life, back green with blue reflections; sides and below silvery white, with bluish and purplish reflections; a distinct black blotch on upper angle of opercle, extending on shoulder girdle; inside of opercle, and skin lining shoulder girdle below, largely dusky. A quadrate black blotch on back of tail, extending backward along bases of upper caudal rays. Fins light yellowish, the dorsal and anal edged with black; tip of upper caudal lobe black. Ventrals whitish. Tongue, base and roof of mouth, and skin of upper branchiostegals black. Pacific Coast of tropical America, Magdalena Bay (Steindachner) to Panama (Gilbert); common at Panama, but not seen at Mazatlan either by Gilbert or Jordan. (*Orqueta*, the Spanish name at Panama.)

*Chloroscombrus orqueta*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 646, **Panama**. (Type, Nos. 29165, 29278, 29285, and 29343. Coll. Gilbert.)

*Chloroscombrus stirurus*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1883, 206, (*lapsus* for *orqueta*, uncorrected proof sheet).

### 1334. CHLOROSCOMBRUS CHRYSURUS (Linnæus).

(CASABE; BUMPER.)

Head 3¾; depth 2⅓; eye very large, longer than snout, about 3 in head. D. VIII-I, 26; A. II-I, 26. Head rather deeper than long; opercles very short; snout short. Mouth very oblique; maxillary reaching anterior margin of eye. Chord of curved part of lateral line scarcely longer than head, 1⅔ to 1¾ times in length of straight part. Lateral line wholly unarmed. Caudal peduncle longer than deep, its diameter less than that of eye; ventrals very small, fitting into a groove in which the vent is situated; pectorals long, falcate, ⅓ the length. Greenish above, sides and below golden; caudal peduncle dusky above; dark opercular and axillary spots; inside of mouth black; fins not bordered or tipped with black. Cape Cod to Brazil; very common on our south Atlantic Coast and in Cuba; not valued as food, the flesh thin and dry, the bones large. (*χρυσός*, gold; *οὐρά*, tail.)

*Scomber chrysurus*, LINNÆUS, Syst. Nat., XII, 494, 1766, **Charleston, South Carolina**.

*Scomber chloris*, BLOCH, Ichthyologia, plate 339, 1793.

*Micropteryx cosmopolita*, AGASSIZ, Spix, Pisc. Bras., 104, 1829, **Brazil**.

*Seriola cosmopolita*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IX, 219, pl. 256, 1833.

*Scomber latus*, GRONOW, Catalogue Fishes, Ed. Gray, 127, 1854, **Carolina**.

*Chloroscombrus caribbæus*, GIRARD, Mex. Bound. Surv. Zoöl., 21, pl. 9, fig. 6, 1859, **St. Joseph Island, Texas**. (Coll. Würdemann.)

*Micropteryx chrysurus*, GÜNTHER, Cat., II, 460, 1860.

*Chloroscombrus chrysurus*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 437; JORDAN & GILBERT, Synopsis, 441, 1883; JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1883, 206

## 428. TRACHINOTUS,* Lacépède.

(PÁMPANOS.)

*Trachinotus*, Lacépède, Hist. Nat. Poiss., III, 79, 1802, (*falcatus*).
*Cæsiomorus*, Lacépède, Hist. Nat. Poiss., III, 95, 1802, (*blochii*).
*Acanthinion*, Lacépède, Hist. Nat. Poiss., IV, 500, 1803, (*rhomboides*).
*Bothrolæmus*, Holbrook, Ich. South Carolina, 82, 1860, (*pampanus*).
*Doliodon*, Girard, Proc. Ac. Nat. Sci. Phila., 1858, 168, (*carolinus*).

Body compressed, moderately elevated, the general outline ovate. Caudal peduncle short and rather slender. Abdomen not trenchant, shorter than the anal fin. Head moderately compressed, very blunt, the snout abruptly truncate. Mouth nearly horizontal, the maxillary reaching the middle of the eye; premaxillaries protractile; maxillary without distinct supplemental bone. Jaws, vomer, and palatines with bands of villiform teeth, which are deciduous with age. Preopercle entire in the adult. Gill rakers short. Gill membranes considerably united. Spinous dorsal represented by 6 rather low spines, which are connected by membrane in the young but are free in the adult. In old specimens the spines appear small on account of encroachments of the flesh, and ultimately often disappear. Second dorsal long, elevated in front; anal opposite to it and similar in form and size; 2 stout, nearly free spines in front of anal, and 1 connected with the fin, these often disappearing with age. Scales small, smooth. Lateral line unarmed, little arched; no caudal keel. "When extremely young the preoperculum is armed at the angle with 3 large spines, and smaller ones above and below. The spinous dorsal is developed as a perfect fin, and teeth are present on the jaws and palatine arch. In this stage the species has never been described by previous naturalists, and consequently has received no name, as the corresponding stage of *Naucrates* (*Nauclerus*) has. At an early period the preopercular spines are absorbed into the substance of the preoperculum and disappear. The spinous dorsal and the teeth are still retained. In this condition it remains for some time, the spinous dorsal, however, gradually losing its relative size, while the soft vertical fins increase. In this stage the species belongs to the genus *Doliodon* of Girard. At a later period the membrane connecting the dorsal spines has become obsolete, and the species then represents the genus *Trachynotus*, as understood by Cuvier & Valenciennes, and others. Finally, in old age, the teeth of the jaws, palate, and pharyngeal bones have fallen out, and the lobes of the dorsal, anal, and caudal fins attain their greatest extension and become pointed. This final stage has been made known by Holbrook under the new generic name of *Bothrolæmus*" (Gill, Proc. Ac. Nat. Sci. Phila., 1862, 440). The pseudobranchiæ also disappear in old specimens. Some of the species of *Trachinotus* (*carolinus*, etc.) are among the most highly valued of our food-fishes. Most or them are, however, not of superior quality. (*τραχύς*, rough; *νῶτος*, back; hence properly written *Trachynotus*.)

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* For a review of the species of *Trachinotus*, see Meek & Goss, Proc. Ac. Nat. Sci. Phila., 1884, 121.

*a.* Dorsal with 19 to 20 soft rays; anal with 17 to 19 soft rays.

*b.* Body very much compressed; sides with narrow black cross bars; lobes of vertical fins elongate, reaching past middle of caudal fin in adult.

*c.* Snout subtruncate or nearly vertical; profile from supraorbital to front of dorsal fin convex. GLAUCUS, 1335.

*cc.* Snout low, very oblique; profile from supraorbital region to dorsal scarcely convex; bands on body narrow, obsolete in the young; vertical fins with red. RHODOPUS, 1336.

*bb.* Body moderately compressed; sides without narrow black cross bars; lobes of vertical fins shorter, rarely reaching base of caudal; lobes of dorsal and anal usually blackish.

*d.* Body broad, ovate; the back arched; the greatest depth at all ages nearly ⅔ length of body; profile from nostril to dorsal everywhere nearly evenly convex; axil without black spot.

*e.* Lobes of vertical fins much elevated, that of dorsal in adult much longer than head; color pale. FALCATUS, 1337.

*ee.* Lobes of vertical fins low, that of dorsal in adult shorter than head; color dusky. CULVERI, 1338.

*dd.* Body oblong, the profile not strongly arched; the depth in young and old 2 to 2⅗ in length of body; dorsal lobes low.

*f.* Axil with a jet-black spot; depth about 2¼ in length; snout blunt, projecting beyond the mouth. KENNEDYI, 1339.

*ff.* Axil not black; depth about 2⅗ in length. GOODEI, 1340.

*aa.* Dorsal with 25 to 27 soft rays; anal with 22 to 26 soft rays; body oblong, rather robust; greatest thickness 3 in greatest depth of body; depth less than half length; lobes of vertical fins short, not black; sides without dark cross bars.

*g.* Dorsal with 25 soft rays; anal with 22 soft rays; profile from snout to procumbent spine evenly convex.

*h.* Body very deep, the depth about half length. ARGENTEUS, 1341.

*hh.* Body moderately deep, the depth about 2½ in length.

*i.* Head moderate, about 4 in body; dorsal lobe pale. CAROLINUS, 1342.

*ii.* Head large, 3¼ to 3½ in body; dorsal lobe black. PALOMA, 1343.

*gg.* Dorsal with 27 soft rays; anal with 26. CAYENNENSIS, 1344.

### 1335. TRACHINOTUS GLAUCUS (Bloch).

(GAFF-TOPSAIL PÁMPANO; OLD WIFE; PALOMETA.)

Head 4; depth 2; eye 3⅗. D. VI–I, 19; A. II–I, 18. Pyloric cœca 13. Body elliptical, much compressed; snout blunt, subtruncate, vertical from mouth to horizontal from upper edge of eye; the profile from supraorbital to front of dorsal fin convex. Mouth nearly horizontal; maxillary nearly reaching vertical from middle of eye, its length 3 in head; jaws without teeth in the adult; dorsal spines separate in the adult; dorsal and anal fins falcate, the anterior soft rays reaching middle of caudal fin; dorsal lobe 1½, anal 1¾ in length of body; ventrals reaching ⅘ distance to vent, their length 2⅖ in head; caudal very deeply forked, its lobes nearly half length of body. Color bluish above, golden below; lobes of dorsal and anal very dark; rest of fins pale, with bluish edges; caudal bluish; pectorals golden and bluish; ventrals whitish. Body crossed by four black vertical bands; the first is under the procumbent spine, the second under the third dorsal spine, the third and fourth under the soft dorsal; a black spot, representing a fifth band, on lateral line between last rays of dorsal and anal; this is sometimes obsolete; the position of these bands appears to be subject to slight variation.

The young of this species has not yet been described. Length 13 inches. Tropical America, from Virginia to the Caribbean Sea, generally common from Carolina to Florida; a very handsome fish, not highly valued. (*glaucus*, γλαυκός, hoary blue.)

*Chætodon glaucus*, Bloch, Ichthyol., pl. 210, 1787, **Martinique**; on a figure by Plumier.

*Trachinotus glaucus*, Cuvier & Valenciennes, Hist. Nat. Poiss., VIII, 400, 1831; Jordan & Gilbert, Proc. U. S. Nat. Mus., 270, 1882; Jordan & Gilbert, Synopsis, 443, 1883; Meek & Goss, Proc. Ac. Nat. Sci. Phila., 122, 1884.

*Trachynotus glaucus*, Günther, Cat., II, 483, 1860; Gill, Proc. Ac. Nat. Sci. Phila., 438, 1862.

### 1336. TRACHINOTUS RHODOPUS, Gill.

(Pampanito.)

Head 3½; depth 2. D. VI–I, 20; A. II–I, 18. Body more elevated than in *Trachinotus glaucus*, the snout lower and the anterior profile much more straight; mouth rather large, oblique, the jaws nearly equal; the snout low, somewhat prominent. Anterior rays of dorsal and anal much produced, reaching nearly to middle of caudal in the adult, short in the young; caudal deeply forked, its lobes 2½ in body. Ventrals short, not reaching vent. Bluish green above, silvery below; sides with 5 short, narrow, vertical, blackish stripes, the first two nearer together than the others, the last two sometimes reduced to spots; these bands always faint, obsolete in the young, in which the vertical fins are also much lower; caudal, dorsal, and anal lobes largely of a bright maroon color, or orange brown in life, the anterior edge blackish, shading off into pinkish, this color present at all ages. Pacific Coast of tropical America to Panama; very common on sandy shores, replacing *Trachinotus glaucus*, which it much resembles. The difference in profile is constant and characteristic. Not much valued as food. Length 2 feet. (ῥοδός, rose-colored; πούς, foot.)

*Trachynotus rhodopus*, Gill, Proc. Ac. Nat. Sci. Phila., 1863, 85, **Cape San Lucas**; (Coll. Xantus); young, 2 inches long.

? *Trachynotus nasutus*, Gill, *l. c.*, 1863, 85, **Cape San Lucas**; (Coll. Xantus); young of 1 inch, possibly young of *T. kennedyi*.

*Trachynotus fasciatus*, Gill, Proc. Ac. Nat. Sci. Phila., 1863, 86, **Panama**; Günther, Fish. Centr. Amer., 434, 1869: Meek & Goss, Proc. Ac. Nat. Sci. Phila., 1884, 123.

*Trachynotus glaucoides*, Günther, Proc. Zoöl. Soc. Lond., 1864, 150, **San Jose de Guatemala**.

### 1337. TRACHINOTUS FALCATUS* (Linnæus).

(Round Pámpano; Palometa.)

Head 3¾; depth 1⅗. D. VI–I, 19; A. II–I, 18. Body broadly ovate, moderately compressed, profile very evenly convex from procumbent spine to level of upper edge of eye, where it descends almost vertically. The vertical portion is about 1⅓ times the eye; length of snout nearly equal to eye; mouth nearly horizontal; maxillary reaching to vertical from middle of eye, its length 2⅔ in head; jaws without teeth in adult; dorsal

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*Should *Trachinotus falcatus* prove to be identical with the East Indian *T. ovatus*, as several writers have supposed, the American name, *falcatus*, has precedence of date.

spines short and thick, not connected by membrane in adult; ventrals short, their tips scarcely reaching halfway to anterior anal spine, 3 in head; caudal widely forked; lobes about 2⅔ in length of body; dorsal and anal fins falcate; anterior rays reaching almost to posterior end of fins; in adults, dorsal lobe 2⅔, anal lobe 4½, in length of body. Color bluish above, silvery below; lobes of dorsal black in young; in adults the fins are all bluish with lighter tips. The young differ from the adult as above described in the following respects: The profile is scarcely convex; snout shorter and less vertical; spines much longer and connected by membranes; lobes of vertical fins shorter; dorsal lobe with black; fins all much darker; jaws with bands of villiform teeth; eye larger. West Indies; Cape Cod to Brazil; abundant southward; ranging north in the Gulf Stream to Woods Hole, the adult rarely taken northward. As a food-fish this species is less valuable than its congener, *carolinus*. (*falcatus*, scythe-shaped.)

*Labrus falcatus*, Linnæus, Syst. Nat., Ed. x, 1758, 284, America; Museum de Geer.

*Trachinotus falcatus*, Jordan, Proc. U. S. Nat. Mus., 575, 1886; Meek & Goss, *l. c.*, 1884, 124.

*Chætodon rhomboides*, Bloch, pl. 209, 1787, Martinique; on a drawing made by Plumier.

*Trachinotus spinosus*, De Kay, N. Y. Fauna: Fishes, 117, pl. 19, fig. 53, 1842, New York Harbor.

*Acanthinion rhomboides*, Lacépède, Hist. Nat. Poiss., iv, 500, 1803.

*Trachinotus rhomboides*, Cuvier & Valenciennes, Hist. Nat. Poiss., viii, 407, 1831.

*Trachynotus rhomboides*, Jordan & Gilbert, Synopsis, 974, 1883.

*Trachinotus fuscus*, Cuvier & Valenciennes, Hist. Nat. Poiss., viii, 410, 1831, Brazil.

*Trachynotus ovatus*, Günther, Cat., ii, 481, 1860, (in part, not of Linnæus), and of many recent writers.

### 1338. TRACHINOTUS CULVERI, Jordan & Starks.

Head 3⅖; depth 1½. D. VI–I, 17; A. II–I, 17. Maxillary 3 in head; eye 3⅔; snout 4⅓. Dorsal lobe 1 1/10 in head; pectoral 1 1/10; caudal ⅙ longer than head. Body very deep, compressed, the back much elevated. Snout very blunt and convex, the rest of profile straight and steep; lower jaw somewhat included; base of dorsal and anal very oblique. Dorsal and anal lobes rather low. Caudal long. Lateral line little elevated in front, the curve 1¼ in straight part. Gill rakers very short, about x + 14. Teeth persistent. Bluish gray, silvery below, tinged with yellow, everywhere much soiled with blackish dots, no distinct markings anywhere; the axil only slightly dusky; fins all dusky except middle of caudal and lobe of anal, and the ventrals which are whitish. Five specimens, each about 8 inches long taken in the Astillero at Mazatlan. Close to *Trachinotus falcatus* and to *T. ovatus*, but with the vertical fins lower. (Named for George Bliss Culver, its collector, a member of the Hopkins Expedition to Sinaloa, December, 1894.)

*Trachinotus culveri*, Jordan & Starks, Rept. Fishes Sinaloa, MS., 1895, Mazatlan. (Type, No. 2691, L. S. jr., Univ. Mus. Coll. Hopkins Expedition.)

### 1339. TRACHINOTUS KENNEDYI, Steindachner.

(Palometa.)

Head 3⅔; depth at vent 2⅓; at anal 2 1/10 in specimens 2 feet long, young somewhat deeper, with lower fins. D. VI–I, 19; A. II–I, 16. Curve of lateral line ⅗ in straight part. Eye 5 in head; maxillary 2⅔. Dorsal lobe 1⅕;

caudal lobes ¼ longer than head. Pectoral 1¼ in head. Snout 3⅖. Least depth of caudal peduncle 3½ in head. Body oblong, compressed, and elevated at bases of dorsal and anal. Anterior profile of head an even curve, the snout blunt and convex, line straight from nape to dorsal. Mouth moderate, very oblique, subinferior, the lower jaw much shorter than upper, the maxillary reaching to posterior border of pupil. Teeth obsolete. Tail widely forked, the lobes equal. Lobes of dorsal and anal low, not sharp. Gray above with deep-green reflections, lower half silvery, with strong golden tinge; axil jet black, the color covering base of fin and extending behind for a distance nearly equal to eye, so that the fin does not cover it, this mark said to be faint or wanting in the young; upper fin dusky, the caudal edged with paler; anal dusky with golden tinge; ventrals purplish white; pectorals dusky; maxillary with a blackish streak. Tropical America, in the surf, rather common from Bahia de Magdalena to Panama; here described from a large specimen from Mazatlan, deeper in body than Steindachner's types, which have the depth 1⅗ to 2 in length. The Pacific Coast representative of *Trachinotus goodei.* (Named for its discoverer, Lieutenant Kennedy, of the steamship *Hassler.*)

*Trachynotus kennedyi*, STEINDACHNER, Ichth. Beitr., III, 47, pl. VII, 1875, Magdalena Bay.
*Trachinotus kennedyi*, MEEK & GOSS, *l. c.*, 1884, 123.

### 1340. TRACHINOTUS GOODEI, Jordan & Evermann, new species.

(PERMIT; PALOMETA; GREAT PÁMPANO.)

Head 3; depth 2⅗. D. VI–I, 19; A. II–I, 17. Body oblong, elliptical, moderately compressed; profile nearly straight from procumbent spine to nostril, where it descends nearly vertically, forming an angle; vertical portion from angle to snout nearly equaling eye; snout obliquely truncated; maxillary reaching slightly behind vertical from middle of eye, its length 2⅗ in head; jaws with bands of villiform teeth (these disappearing with age); ventrals reaching ⅘ distance to vent, their length 2 in head; tips of pectorals reaching slightly past tips of ventrals; dorsal and anal fins falcate, their anterior soft rays less elevated than in *Trachinotus falcatus*, but extending beyond middle of fins when depressed, their length in the young 4 in length of body; caudal forked, lobes about 3 in body; lateral line nearly straight, slightly curved upward above the pectorals. Color bluish silvery above, silvery below; dorsal, caudal, and anal lobes black; no cross bars. Length 3 feet. West Indies, north to West Florida; not very common. Here described from a small specimen from Key West, the characters of the adult taken from Günther. The species reaches a very large size, larger than any of the others in American waters. The species is allied to the African *Trachinotus goreensis*, Cuvier & Valenciennes, but it has fewer dorsal rays (D. VI–I, 22, in *T. goreensis*). (Named for Dr. G. Brown Goode, who first noticed the species as an inhabitant of the waters of the United States.)

*Trachynotus goreënsis*, GÜNTHER, Cat., II, 483, 1860, in part; not of CUVIER & VALENCIENNES; GOODE & BEAN, Proc. U. S. Nat. Mus., 1879, 112 and 339; specimen nearly 3 feet long.
*Trachinotus rhodopus*, JORDAN & GILBERT, Synopsis, 442, 1883, and of MEEK & GOSS, *l. c.*; not of GILL.

*Trachinotus goodei*, JORDAN & EVERMANN, MS., Key West, Florida. (Coll. Jordan. Type, No. 1455, L. S. Jr. Univ. Mus.)
*Trachynotus carolinus*, POEY, Synopsis, 371, 1868; not of other authors.

### 1341. TRACHINOTUS ARGENTEUS, Cuvier & Valenciennes.

Depth 2 in length in specimens 6 inches long ($2\frac{1}{10}$ in original type, a foot long); caudal lobes $3\frac{1}{5}$. D. VI–I, 24; A. II–I, 21, (D. 25; A. 23, in original type). Lobes of dorsal and anal reaching to middle of base of fin. Silvery, with blackish on tip of dorsal lobe and on middle of pectoral. Atlantic Coast, usually confounded with *Trachinotus carolinus*, if really distinct from it. According to Dr. Bean, this may be a valid species, allied to *Trachinotus carolinus*, but with the body deeper, the depth being half length without caudal. West Indies. We have seen only the original type of *argenteus* in the museum at Paris, from "America." (*argenteus*, silvery.)

*Trachinotus argenteus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., VIII, 413, 1831, New York and Rio Janeiro. (Coll. Delalande. Coll. Milbert.)
*Trachinotus cupreus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., *l. c.*, VIII, 414, 1831, Martinique. (Coll. Plée.)

### 1342. TRACHINOTUS CAROLINUS (Linnæus).

(COMMON PÁMPANO.*)

Head 4; depth $2\frac{1}{3}$ to $2\frac{2}{5}$. D. VI–I, 25; A. II–I, 23. Body oblong, comparatively robust; greatest thickness 3 in greatest depth. Snout from mouth to horizontal from upper edge of eye nearly vertical, somewhat bluntly rounded; profile from upper edge of snout to procumbent spine evenly convex. Mouth nearly horizontal, maxillary reaching to vertical from middle of eye, its length $2\frac{7}{8}$ in head; eye $4\frac{1}{2}$ in head, about as long as snout. Jaws without teeth in adult. Ventrals reach $\frac{3}{5}$ distance to vent, about 2 in pectorals, $2\frac{1}{2}$ in head. Dorsal and anal fins falcate, anterior rays nearly reaching middle of fins when depressed; dorsal lobe $4\frac{1}{2}$ in body; anal $5\frac{1}{2}$ in length of body. Color bluish above, silvery or slightly golden below; pectorals and anal light orange shaded with bluish; caudal and upper portion of caudal peduncle with bluish reflections. Length 18 inches. South Atlantic and Gulf coasts of United States, ranging north to Cape Cod on sandy shores, very common southward, rare or accidental in the West Indies and in Brazil. The most valued food-fish in our southern waters, its flesh rich, firm, and delicate, superior to all others of its genus or family. On the Pacific Coast it is scarcely known as a food-fish, perhaps from its scarcity. (*carolinus*, from Carolina.)

*Gasterosteus carolinus*, LINNÆUS, Syst. Nat., Ed. XII, 490, 1766, Carolina. (Coll. Dr. Garden.)
? *Trachynotus argenteus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., VIII, 410, 1831, New York; Rio Janeiro.
? *Trachynotus cupreus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., VIII, 414, 1831, Martinique.
*Trachynotus pampanus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., VIII, 415, 1831, Brazil; Charleston.
*Trachynotus carolinus*, JORDAN & GILBERT, Synopsis, 442, 1883.
*Trachinotus carolinus*, MEEK & GOSS, *l. c.*, 1884, 127, and of most recent writers.

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* This word (meaning grape leaf) is properly spelled Pámpano, not Pompano.

### 1343. TRACHINOTUS PALOMA, Jordan & Starks.

Head 3⅓ to 3⅙; depth 2½. D. VI–I, 24; A. II, I, 23; eye 3⅓ in head; snout 2⅔; maxillary 2⅓. Dorsal lobe 1⅔ in head; caudal 1⅒. Body rather elongate, the back moderately and regularly arched; snout bluntish; the profile straight from before eye to dorsal. Mouth large, horizontal, the jaws subequal, maxillary reaching past pupil. Lateral line little arched, its curve 1⅙ in straight part. Teeth well developed. Caudal not widely forked. Gill rakers shortish, about 8 below angle; dorsal and anal lobes about reaching middle of fin. Silvery, without spot or band; anal creamy orange, its tip whitish. Other fins pale, except dorsal lobe, which is blackish; pectoral a little dark, axil silvery. West coast of Mexico; rather scarce, found on sandy shores. Length about a foot. Recorded from Cape San Lucas, Mazatlan, and San Juan Lagoon. It is extremely close to *Trachinotus carolinus*, but has the head rather larger. As a food-fish it is unknown to Mexican fishermen, who do not distinguish it from other species. Here described from 2 specimens from Mazatlan, and from 4 from San Juan Lagoon, the largest 5 inches long. (*paloma*, a dove, a name applied to fishes of this group.)

*Trachinotus paloma*, JORDAN & STARKS, Rept. Fishes Sinaloa, MS., 1895, Mazatlan. (Type, No 213, L. S. Jr. Univ. Mus. Coll. Hopkins Expedition to Mazatlan.)

### 1344. TRACHINOTUS CAYENNENSIS,* Cuvier & Valenciennes.

Depth (in young of 2½ inches) 2 in length. D. V–I, 27; A. II–I, 26. Form of *Trachinotus falcatus*, the body very deep, the snout short and very blunt; eye very large; preopercle (in type) with very strong spines. Dorsal lobe 2 in head, in young. Fins all pale. Coloration plain. Cayenne; known from one very young specimen in the museum at Paris, in bad condition, examined by us. Close to *Trachinotus falcatus*, but with more numerous fin rays.

*Trachinotus cayennensis*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., VIII, 417, 1831, Cayenne; GÜNTHER, Cat., II, 485, 1860 (copied); MEEK & GOSS, *l. c.*, 1884, 129.

## Family CXXVI. POMATOMIDÆ.

### (THE BLUEFISHES.)

Body oblong, compressed, covered with rather small scales, which are weakly ctenoid. Caudal peduncle rather stout. Head large, compressed. Mouth large, oblique. Premaxillaries protractile; maxillary not slipping under the preorbital, provided with a large supplemental bone; lower jaw projecting; bands of villiform teeth on vomer and palatines, those on the vomer forming a triangular patch; jaws each with a single series of very strong, compressed, unequal teeth, widely set; upper jaw with an inner series of small depressed teeth; villiform teeth on the base of the tongue. Occipital keel strong; free edge of preopercle produced and serrated. Gill membranes free from the isthmus, not united. Branchiostegals 7; gills 4, a slit behind the fourth. Pseudobranchiæ large. Gill rakers slender, rather few. Opercle ending in a flat point. Cheeks and opercles scaly; lateral line present, unarmed. Dorsal fins 2, the anterior of about 8 weak, low spines, connected by membrane and depressible in a groove; second dorsal long, similar to the elongate anal, both fins being densely scaly; fin rays slender; 2 very small, free anal spines, sometimes hidden in the skin; ventrals thoracic, I, 5; peduncle stout; pectorals rather short; caudal fin forked, the lobes broad; air bladder simple, with thin walls. Pyloric cœca very numerous. Vertebræ $10+14=24$, as usual in *Carangidæ*. A single species, found in nearly all warm seas. This family is closely related to the *Carangidæ*, from which group it seems to be an offshoot toward the Percoids. (*Carangidæ*, genus *Temnodon*, Günther, Cat., II, 479, 480, 1860.)

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* Similar to this species is *Trachinotus paitensis* from Payta, Peru, also known from a very young example. Depth 2½ in length. D. 28; A. 27. Dorsal lobe black, snout low, bluntish.

## 429. POMATOMUS,* Lacépède.

### (BLUEFISHES.)

*Pomatomus*, LACÉPÈDE, Hist. Nat. Poiss., IV, 436, 1802, (*skib*).
*Gonenion*, RAFINESQUE, Caratteri Alcuni Nuovi Generi, 53, 1810, (*serra*).
*Lopharis*, RAFINESQUE, *l. c.*, 53, 1810, (*mediterraneus* = *lophar*).
*Temnodon*, CUVIER, Règne Animal, Ed. 2, Vol. II, 206, 1829, (*saltator*).
*Sypterus*, EICHWALD, Fauna Caspio-Caucasana, 1841.
*Chromis*, (Garden MS.) GRONOW, Cat. Fishes, Ed. Gray, 1854, 149, (*epicurorum*).
*Cheilodipterus*, BLEEKER, Nat. Verh. Holl. Maats., Wet. V, 2, No. 1, 74, 1874, (*heptacanthus*; not of LACÉPÈDE, as earlier restricted by CUVIER).
*Sparactodon*, DE ROCHEBRUNE, Bull. Sci. Philom. Paris, IV, 159, 1880, (*nalnal*).

Characters of the genus included above. (*πῶμα*, operculum; *τόμος*, cutting; from the serrated preopercle.)

### 1345. POMATOMUS SALTATRIX (Linnæus).

(BLUEFISH; SNAP MACKEREL; SKIPJACK; FAT-BACK.)

Head 3½; depth 4. D. VIII-I, 25; A. II-I, 26; scales 95. Body robust, moderately compressed; belly compressed to a bluntish edge. Head deep; top of head and a ridge on each side above the cheeks naked. Cheeks much longer than opercles. Pectorals placed rather low, their length a little more than half that of head. Coloration bluish or greenish above, silvery below; a blackish blotch at base of pectoral. Length 3 feet.

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* The following words of Mr. D. G. Elliot, are pertinent as to cases of this kind, in which the generic name commonly used can claim no right of priority:

"The law of priority is very clear in regard to the treatment of such cases, but some naturalists object to have it enforced on the ground of expediency, and because it would be apt to create confusion. Doubtless such would be the temporary result in this and all similar instances when errors are corrected which have been continued by writers who have simply followed each other without making independent investigations; but the confusion is originally caused by those who commit errors, not by those who correct them. * * * It may be inconvenient for those who have become familiar with any special group to have their ideas of its nomenclature disturbed, by showing that errors have been committed and then knowingly continued; but that would be a most indefensible reason to advance why these should not be corrected. * * * Conservatism is an excellent principle when it serves as a bulwark against the commission of abuses, but it is a most baleful principle when it is exerted against the correction of errors."—*Daniel G. Elliot: Monograph of the Pittidæ.*

Atlantic and Indian oceans; widely distributed; of late years very abundant on our Atlantic Coast; a large, voracious fish, extremely destructive to other fishes; highly valued for food, the flesh being most excellent. Occasional in the Mediterranean; (specimens from Athens examined by us). (*saltatrix*, one who leaps.) (Eu.)

*Perca saltatrix*, LINNÆUS, Syst. Nat., Ed. x, 1758, I, 293, Carolina; after *Perca marina saltatrix*, the Skipjack of CATESBY.

*Perca lophar*, FORSKÅL, Descr. Anim., 1775, Constantinople.

*Cheilodipterus heptacanthus*, LACÉPÈDE, Hist. Nat. Poiss., Fort Dauphin, Madagascar.

*Pomatomus skib*, LACÉPÈDE, Hist. Nat Poiss, IV, 436, 1802, Carolina.

*Lopharis mediterraneus*, RAFINESQUE, Indice, 17, 1810; after FORSKÅL.

*Gonenion serra*, RAFINESQUE, Indice, 53, 1810, Sicily.

*Chromis epicurorum*, GRONOW, Cat., Ed. Gray, 149, 1854, Carolina; "Piscis sapidissimus et palato epicurorum gratissimus."

*Sparactodon nalnal*, DE ROCHEBRUNE, Bull. Sci. Philom. Paris, 159, 1880, Senegambia.

*Gasterosteus saltatrix*, LINNÆUS, Syst. Nat., Ed. XII, 491, 1766.

*Temnodon saltator*, CUVIER & VALENCIENNES, Hist. Hat. Poiss., IX, 225, 1833; STORER, Hist. Fish. Mass., 159, pl. 15, fig. 1, 1839; GÜNTHER, Cat., II, 479, 1860; STEINDACHNER, Ichth. Beiträge, 1881.

*Pomatomus saltator*, JORDAN & GILBERT, Synopsis, 448, 1883.

*Pomatomus saltatrix*, JORDAN & GILBERT, Synopsis, 914, 1883.

## Family CXXVII. RACHYCENTRIDÆ.*

### (SERGEANT FISHES.)

Body elongate, fusiform, subcylindrical, covered with very small, smooth, adherent scales. Lateral line nearly parallel with the back. Head rather broad, low, pike-like, the bones above appearing through the thin skin. Mouth rather wide, nearly horizontal, the maxillary about reaching front of eye; both jaws, vomer, palatines, and tongue with bands of short, sharp teeth; lower jaw longest; premaxillaries not protractile; preopercle unarmed. First dorsal represented by about 8 low, stout, equal, free spines, each depressible in a groove; soft dorsal long and rather low, somewhat falcate, similar to and nearly opposite anal; 2 weak anal spines, one of them free from the fin; pectorals moderate, placed low; ventrals thoracic, I, 5; caudal fin strong, forked, on a moderate peduncle; no caudal keel; no finlets. Gill rakers rather short, stout; no air bladder; branchiostegals 7; pyloric cœca branched; vertebræ 12 + 13 = 25. A single genus with probably but one species; a large, strong, voracious shore fish, found in all warm seas. Its relations are with the Scombroid fishes, although not close to any of the other groups. The superficial resemblance

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*The osteology of this family is given as follows by Dr. Gill: "Acanthopterygians with a depressed, broad, distegous cranium, the medifrontines double, plane, sculptured, and perfectly ecarinate; the sphenotics with the upper surface plane and scarcely declivous; the parethmoids exserted, with the upper surface nearly continuous with the medifrontines and the lower with the parasphenoid, and imperforate; the prosethmoid with a large and nearly square tabular surface and a short declivous portion at a very obtuse angle with the former; the supraoccipitine with an anterior ecarinate plane portion and a posterior cristiform portion; the lateral posterior crests very low, depressed, and ceasing at the medifrontines; the basioccipitine solid below; the exoccipitine condyles distant from each other; the parasphenoid very broad and ecarinate; the contour of the body fusiform; the head wedge-shaped and broad; the scales small and cycloid; the caudal fin with procurrent raylets; dorsal fin long and preceded by free spines reclinable in grooves, and normal pectoral and ventral fins."

*Rachycentron* bears to *Echeneis*, as Dr. Gill has shown, is not connected with any intimate homology. (*Scombridæ*, part, Günther, Cat., II, 375, 1860; *Rachicentridæ*, Gill, Proc. U. S. Nat. Mus., 1895.)

### 430. RACHYCENTRON, Kaup.

*Rachycentron*, Kaup, Isis, XIX, Col. 89, 1826, (*typus*).
*Rachicentron*, Kaup, Isis, XX, Col. 624, 1827; emended spelling.
*Les Elacates*, Cuvier, Règne Animal, Ed. 2, II, 203, 1829.
*Elacate*, Cuvier & Valenciennes, Hist. Nat. Poiss., VIII, 328, 1831, (*malabarica* = *canadus*).

Characters of the genus included above. (*ῥάχις*, lower part of back; *κέντρον*, spine.)

#### 1346. RACHYCENTRON CANADUS (Linnæus).

(Sergeant Fish; Crab Eater; Bonito; Cobia.)

Head 4¼; depth 5⅔. D. VIII–I, 26; A. II, 25. Head much depressed; mouth moderate, the short maxillary reaching front of orbit. Pectorals broad and falcate; caudal deeply emarginate, the upper lobe slightly the longer. Lateral line wavy and irregular, descending posteriorly. Olive brown, sides with a distinct broad band of darker, and a less distinct band above and below it; silvery below. Length 5 feet. Warm seas; common on our Atlantic Coast in summer, especially in Chesapeake Bay and southward; north to Cape Cod; not recorded from the Eastern Pacific, but abundant in the East Indies. (Name from Canada, where the species is not found.)

*Gasterosteus canadus*, Linnæus, Syst. Nat., Ed. XII, 491, 1766, Carolina. (Coll. Garden.)
*Scomber niger*, Bloch, Ichthyologia, plate 337, 1793.
*Centronotus gardenii*, Lacépède, Hist. Nat. Poiss., III, 357, 1803, Carolina.
*Centronotus spinosus*, Mitchill, Trans. Lit. and Philos. Soc. N. Y., I, 490, pl. 3, fig. 9, 1815, New York.
*Elacate pondiceriana*, Cuvier & Valenciennes, Hist. Nat. Poiss., VIII, 329, 1831, Pondicherry.
*Elacate motta*, Cuvier & Valenciennes, Hist. Nat. Poiss., VIII, 332, 1831, Orixa.
*Elacate malabarica*, Cuvier & Valenciennes, Hist. Nat. Poiss., VIII, 332, 1831, Malabar.
*Elacate atlantica*, Cuvier & Valenciennes, Hist. Nat. Poiss., VIII, 334, 1831, Brazil.
*Elacate canada*, De Kay, N. Y. Fauna: Fishes, 113, pl. 25, fig. 77, 1842.
*Elacate bivittata*, Cuvier & Valenciennes, Hist. Nat. Poiss., VIII, 338, 1831, Molucca.
*Elacate falcipinnis*, Gosse, Jamaica, 208, 1851, Jamaica.
*Elacate nigra*, Günther, Cat., II, 375, 1860.
*Elacate canada*, Jordan & Gilbert, Synopsis, 418, 1883.

## Family CXXVIII. NOMEIDÆ.

Body oblong, compressed, covered with cycloid scales; lateral line continuous and unarmed; head compressed; opercula unarmed; nostrils double; mouth with a lateral cleft; upper jaw scarcely protractile; teeth small and conical, on the palate as well as jaws; gill membranes free from the isthmus; branchiostegal rays 5 or 6; dorsal more or less divided, and with the spinous portion shorter than the soft, but well developed, and the spines slender. Skeleton with numerous vertebræ (in *Nomeus* 16 + 25); pyloric appendages very numerous. Genera 6 or 8; species about 15, mostly of the open sea; small fishes, rarely used as food. (*Nomeina*, Günther, Cat., II, 387, 1860.)

NOMEINÆ:

- *a.* Finlets none.
  - *b.* Ventrals very long and broad, longer than the pectorals; attached by a membrane to the abdomen and depressible in a deep furrow; mouth narrow; teeth on jaws, vomer, and palatines. NOMEUS, 431.
  - *bb.* Ventrals moderate, much shorter than pectorals; snout inflated. PSENES, 432.

## 431. NOMEUS, Cuvier.

*Nomeus*, CUVIER, Règne Anim., Ed. I, II, 315, 1817, (*gronovii*).

Body oblong, rather compressed, covered with rather small cycloid scales. Head flattish above; occipital crest little developed; cleft of the mouth narrow. Teeth small, in a single series in the jaws; teeth on the vomer and palatines. Pseudobranchiæ large. First dorsal with 10 or 11 spines; second dorsal and anal very long, similar to each other, without finlets; anal fin with 3 rather strong spines, none of them free; caudal fin not deeply forked; ventral fins long and broad, attached to the belly by a membrane, depressible in a deep furrow in the abdomen. Lateral line running high. Air bladder present. Pyloric cœca very numerous. Vertebræ 16 + 25. Small fishes of the warm seas, our species living commonly under the protection of the "Portuguese Man-of-War," swimming freely among its poisoned tentacles. Goode & Bean mention the capture of 10 individuals under a single colony of this "Man-of-War." (*νόμευς*, pastor; early travelers having compared the fish to a mullet, *harder* or *berger* in Dutch.)

### 1347. NOMEUS GRONOVII (Gmelin).

(PORTUGUESE MAN-OF-WAR FISH; HARDER; PASTOR.)

Head $3\frac{2}{5}$; depth $3\frac{4}{5}$; eye $3\frac{1}{5}$; snout $4\frac{1}{6}$; interorbital width $4\frac{1}{6}$. D. X-I. 26; A. III, 26. Body compressed, back and ventral line equally and gently arched. Maxillary reaching to below the front of the eye; ventrals reaching front of anal,* $1\frac{1}{5}$ in head; pectorals reaching past front of anal, a little longer than head. Brownish above, silvery below, the sides below with large round brown spots; cheeks and opercles silvery; ventrals black, with silvery edgings; anal with 3 brown spots; caudal with brown spots; pectorals brown above, white below. Tropical parts of the Atlantic and Indian oceans in rather deep water, swimming near the surface, very abundant in the Sargasso Sea, common north to Florida and Bermuda, occasionally farther; Woods Hole, Mass. (Barton A. Bean.) Also recorded by Eigenmann from Panama. (Named for Lawrence Theodore Gronow or Gronovius, a senator of Leyden and one of the ablest ichthyologists contemporary with Linnæus.)

*Gobius gronovii*, GMELIN, Syst. Nat., XIII, 1205, 1788, Tropical America; after GRONOW.
*Nomeus gronovii*, GÜNTHER, Cat., II, 387, 1860; JORDAN & GILBERT, Synopsis, 449, 1883.

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* The large fan-shaped ventrals are used in support in resting on the bottom. In swimming they are usually closed in their groove. Goode & Bean.

*Eleotris mauritii*, Bloch & Schneider, Syst. Ichth., 66, 1801, Brazil; after Prince Maurice.
*Gobiomorus gronovianus*, Lacépède, Hist. Nat. Poiss., II, 584, 1799; after Gronow.
*Nomeus maculosus*, Bennett, Proc. Zoöl. Soc., I, 1831, 146, East Indies.
*Seriola argyromelas*, Cuvier & Valenciennes, Hist. Nat. Poiss., IX, pl. 262, 1833.
*Nomeus maculatus*, Valenciennes, in Cuvier, Règne Anim., III, Poiss., pl. 56, fig. 2.
*Nomeus oxyurus*, Poey, Memorias, II, 236, 1860, Havana.

## 432. PSENES, Cuvier & Valenciennes.

*Psenes*, Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 259, 1833, (*cyanophrys*).
*Cubiceps*, Lowe, Proc. Zoöl. Soc. London, 1843, 82, (*gracilis*).
*Atimostoma*, Smith, Ill. Zoöl. S. Africa, Fish., pl. XXIV, about 1842, (*capense*).
*Navarchus*, De Filippi and Verany, Mem. Accad. Sci. Turin, 2d ser., XVIII, 7, (*sulcatus*).
*Trachelocirrus*, Doumet, Rev. et Mag. Zoölogie, 1863, pl. XV, (*mediterraneus*).

Body compressed, covered with cycloid scales of moderate size. Mouth narrow, beneath the short, swollen snout. First dorsal with 6 to 10 spines; second dorsal and anal much longer, similar, without finlets; anal spines 3, joined to soft part of fin; pectorals larger than ventrals. Lateral line unarmed. Small teeth in jaws. Branchiostegals 5 to 7. Warm seas, known chiefly from very young specimens; found in the open ocean. (ψήνη, the osprey, *Pandion*, the allusion not evident.)

*a.* Dorsal rays about XI, I, 34; anal rays III, 34; body deep; unspotted. PELLUCIDUS, 1348.
*aa.* Dorsal rays X, I, 25 to 27; anal rays III, 25 to 27; sides with parallel dark streaks; body deep. CYANOPHRYS, 1349.
*aaa.* Dorsal rays XI, I, 22 or 23; anal rays III, 23; body oblong, much blotched and banded. MACULATUS, 1350.
*aaaa.* Dorsal rays X, I, 15; A. III, 15; body oblong, much spotted and mottled. REGULUS, 1351.

### 1348. PSENES PELLUCIDUS, Lütken.

Head 4; depth 2⅛; eye 2⅗; snout 4. D. XII, 34; A. III, 134. Body high, short, and compressed. Pectorals 1½ in head; ventrals as long as head, extending considerably beyond the end of pectorals; vertical fins quite high, 1⅓ in head, showing a tendency to become falcate posteriorly; caudal fin furcate. Lateral line placed high; scales small. Dentition as in the other species of the genus; teeth in the maxillary finer and farther apart than in the mandible; end of maxillary reaching to vertical from anterior margin of pupil. Nearly colorless and semitransparent. Deep seas, one specimen taken at 32° 24′ N., 76° 55′ W., in 528 fathoms, by the *Albatross*. (Goode & Bean.) (*pellucidus*, transparent.)

*Psenes pellucidus*, Lütken, Spolia Atlantica, 516 (109), fig. 601 (198), 1880, Strait of Surabaja; Goode & Bean, Ocean. Ichth., 221, fig. 228, 1895.

### 1349. PSENES CYANOPHRYS, Cuvier & Valenciennes.

Head 4; depth 1⅘. D. X, I, 25 to 27; A. III, 25 to 27. Snout short, truncate, as long as eye; lower jaw slightly projecting; soft dorsal and anal scaly. Body brownish, with dark parallel lines of dots along the rows of scales, sometimes a bluish streak above each eye. Open sea, widely distributed, in the Atlantic, Pacific, and Indian oceans;

recorded by Lütken from deep water off Jamaica and Martinique. (*κυάνεος*, blue; *ὀφρύς*, eyebrow.)

*Psenes cyanophrys*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IX, 260, pl. 265, 1833, New Iceland; LÜTKEN, Spolia Atlantica, 110, 1880.
*Psenes javanicus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IX, 264, 1833, Java.
*Psenes auratus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IX, 264, 1833, Gulf of Bengal.
*Psenes fuscus*, GUICHENOT, Mém. Soc. Sci. Nat. Cherbourg, 1866, 138, Madagascar.
*Cubiceps multiradiatus*, GÜNTHER, Proc. Zoöl. Soc. Lond., 1871, 661, pl. 61, Manado.

### 1350. PSENES MACULATUS, Lütken.

Head $3\frac{3}{5}$ to $3\frac{2}{3}$; depth about 3. D. XI, I, 22 or 23; A. III, 23. Body rather elongate; eye 3 in head, half longer than snout; fins somewhat scaly; scales behind eye and on interopercle; no others on head. Pectoral length less than depth of body. Teeth in one row in each jaw. Dusky, with diffuse spots forming 7 broad cross bands on back and tail, extending on the fins; first dorsal mostly black, second with 2 dark bands. Open Atlantic. (Lütken.) One specimen taken by the *Albatross* in 27° 49′ N., 76° 12′ W., at the surface in 633 fathoms. According to Lütken, this is very likely the young of *Psenes capensis*, Smith, but that species has D. X, I, 19; A. I, 19. (*maculatus*, spotted.)

*Psenes maculatus*, LÜTKEN, Spolia Atlantica, 110, 1880, open Atlantic, 39° N., 25° 4′ S., and between 34° and 27° W.

### 1351. PSENES REGULUS, Poey.

D. X, I, 15; A. III, 15; V. I, 5. Eye median, 3 in head. Body regularly oval, compressed; teeth uniserial, cylindrical, short, slender, close-set. Silvery with blue spots, some large, others rounded, about 20 in all, distributed without order and about as large as eye, a band passing through eye; cheeks silvery. Coasts of Cuba. Length $3\frac{1}{2}$ inches. (Poey.) Specimens apparently similar to the type of *Psenes regulus* have been recorded under other names from the East Indies. (*regulus*, diminutive of *rex*, king.)

*Psenes regulus*, POEY, Synopsis, 375, 1868, Cuba.
*Cubiceps indicus*, DAY, Proc. Zoöl. Soc. Lond., 1871, 690, Madras.
*Cubiceps panciradiatus*, GÜNTHER, Ann. Nat. Hist., x, 1872, 423, Misol.

## Family CXXIX. CORYPHÆNIDÆ.

### (THE DOLPHINS.)

Body elongate, compressed, covered with small cycloid scales. Cleft of the mouth wide, oblique, the lower jaw projecting. Cardiform teeth in the jaws and on the vomer and palatine bones; a patch of villiform teeth on the tongue; no teeth on the œsophagus. Opercular bones entire. Skull with a crest, which is much more elevated in the adult than in the young. A single, many-rayed dorsal fin, not greatly elevated, extending from the nape nearly to the caudal fin; anal similar, but shorter; both without distinct spines; pectoral fins very short and small; ventrals well developed, thoracic, I, 5, partly received into a groove in the abdomen;

caudal fin widely forked. Lateral line present. Gill membranes free from the isthmus. Branchiostegals 7; no pseudobranchiæ. No air bladder. Pyloric appendages very numerous. Vertebræ about 30. A single genus, with probably but two species. Very large fishes, inhabiting the high seas in warm regions, noted for their brilliant and changeable colors. (*Scombridæ*, genus *Coryphæna*, Günther, Cat., II, 404–408, 1860.)

### 433. CORYPHÆNA, Linnæus.

(DOLPHINS.)

*Coryphæna*, LINNÆUS, Syst. Nat., Ed. x, 1758, 261, (*hippurus*).
*Caranxomorus*, LACÉPÈDE, Hist. Nat. Poiss., III, 26, 1802, (*pelagicus*).
*Lepimphis*, RAFINESQUE, Caratteri, etc., 33, 1810, (*hippuroides*).
*Lampugus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IX, 317, 1833, (*pelagicus*; young form).

Characters of the genus included above. The species are not well known, having been unduly multiplied by authors. According to Dr. Lütken all are probably reducible to two. (κορύφαινα, the name applied by Aristotle to *Coryphæna hippurus*, from κόρυς, helmet; φαίνω, to show.)

*a*. Dorsal rays 55 to 65; anal 26 to 30; adult male with the front greatly elevated, forming a high crest. HIPPURUS, 1352.
*aa*. Dorsal rays 51 to 55; anal 24 to 26; profile of adult male not very steep, not very different from that of the female. EQUISETIS, 1353.

#### 1352. CORYPHÆNA HIPPURUS, Linnæus.

(COMMON DOLPHIN; DORADO; DOURADE.)

Head 4⅔ to 5¾; depth 5. D. 55 to 65; A. 26 to 30. Profile in adult male nearly vertical; maxillary reaching middle of eye or beyond. Vertebræ 30 or 31. Ventrals inserted slightly behind upper ray of pectoral, its length 1¼ in head; pectoral 1½. Colors brilliant in life, the head, body, and tail greenish olive, changing suddenly at death; brownish olive above, white or golden below, with a series of about 15 bright-blue spots on back along each side of dorsal, the largest on the back and head, forming bands on the snout; dorsal purplish blue, with paler oblique lines; other fins tinged with blue; caudal yellow; in spirits pale, with blackish spots on the lower parts. Length 6 feet. Pelagic, north on our coast to Cape Cod; abundant from South Carolina to Texas; not definitely known from the eastern Pacific. Remarkable for its brilliant coloration, which fades at death, although the change has been much exaggerated. A good food-fish. (Eu.) (ἵππος, horse; οὐρά, tail.)

*Coryphæna hippurus*, LINNÆUS, Syst. Nat., Ed. x, 1758, 261, open seas; GÜNTHER, Cat., II, 405, 1860; JORDAN & GILBERT, Synopsis, 914, 1883, and of authors generally.
*Scomber pelagicus*, LINNÆUS, Syst. Nat., Ed. x, 1758, 299, no locality.
*Coryphæna fasciolatus*, PALLAS, Spicil. Zoöl., VIII, pl. 3, fig. 2, 1772, Amboina.
*Coryphæna chrysurus*, LACÉPÈDE, Hist. Nat. Poiss., II, pl. 18, fig. 2, 1799.
*Coryphæna imperialis*, RAFINESQUE, Caratteri, &c., 33, 1810, Sicily.
*Lepimphis hippuroides*, RAFINESQUE, Caratteri, &c., 34, 1810, Palermo.
*Coryphæna immaculata*, AGASSIZ, in Spix, Pisc. Bras., III, pl. 56, 1829, Atlantic, off Brazil.
*Coryphæna marcgravii*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IX, 301, 1833, South America.

*Coryphæna sueurii*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 302, 1833, Philadelphia.
*Coryphæna dorado*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 303, 1833, Brazil.
*Coryphæna dolfyn*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 305, 1833, Antilles.
*Coryphæna virgata*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 308, 1833, Martinique; after Plumier.
*Coryphæna argyrurus*, Cuvier & Valenciennes, *l. c.*, ix, 314, 1833, Sea of Coromandel.
*Coryphæna vlamingii*, Cuvier & Valenciennes, *l. c.*, ix, 315, 1833, seas of India; after Renard.
*Lampugus siculus*, Cuvier & Valenciennes, *l. c.*, ix, 323, 1833, Sicily.
*Coryphæna scomberoides*, Cuvier & Valenciennes, *l. c.*, ix, 315, 1833, South Sea; after *Osteroglossus* of Commerson.
*Coryphæna sueuri*, Jordan & Gilbert, Synopsis, 455, 1883.

### 1353. CORYPHÆNA EQUISETIS, Linnæus.

(Small Dolphin.)

Head $4\frac{1}{5}$ to $4\frac{3}{5}$; depth $3\frac{2}{5}$ to 4. D. 51 to 55; A. 24 to 26; vertebræ 33. Profile of head convex, but not nearly vertical, even in the adult; maxillary reaching front of pupil, $3\frac{4}{5}$ to $4\frac{4}{5}$ in head. Insertion of dorsal behind eye; pectorals equal half length of head; maxillary reaching middle of eye; profile of snout becoming nearly vertical with age; front of anal under middle of body. Colors brilliant in life, changing suddenly at death; brownish olive above, white or golden below, with bright-blue spots, the largest on the back and head, forming bands on the snout; dorsal purplish blue, with paler oblique lines; other fins tinged with blue; caudal yellow; in spirits pale, with blackish spots on the lower parts. "Male with the front elevated, forming a crest, which projects a little beyond the upper jaw; female with blue spots along each side of the tail, regularly arranged." (Poey.) Length 30 inches. Open Atlantic; rare in the West Indies; not recorded from coast of the United States. (*equus*, horse; *seta*, bristle, tail.) (Eu.)

*Coryphæna equisetis*, Linnæus, Syst. Nat., Ed. x, 1758, 261, (misprinted *equiselis*), high seas; after Dorado of Osbeck, Resa China, 308, 1757; Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 297, 1833; Jordan & Gilbert, Synopsis, 914, 1883.
*Coryphæna aurata*, Rafinesque, Caratteri, &c., 33, 1810, Sicily.
*Coryphæna lessonii*, Cuvier & Valenciennes, Hist. Nat. Poiss., 307, 1833, India.
*Lampugus punctulatus*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 327, 1833, Atlantic at the Equator.
*Lampugus neapolitanus*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 325, 1833, Naples; after Bloch.
*Coryphæna azorica*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 306, 1833, Azores.
*Coryphæna punctulata*, Jordan & Gilbert, Synopsis, 454, 1883.

## Family CXXX. LAMPRIDÆ.

(The Mariposas.)

Body ovate, compressed, and elevated, covered with minute, cycloid scales. Head small, rather pointed. Mouth small, terminal, without teeth in the adult, its angle with slits in the skin to permit the motion of the jaws, as in the tunnies. Premaxillaries protractile. Opercular bones entire Dorsal fin single, very long, elevated, and falcate in front, without distinct spines; anal long and low, not at all falcate; both fins depressible in a groove; ventral fins thoracic, but behind the pectorals, attached to a very long pubic bone, composed of 14 to 17 soft rays; pectoral fins large, falcate, their bases horizontal; caudal fin moderately forked, its peduncle short and slender, without keel. A pit at base of caudal, above and below, as in certain sharks. Lateral line present, much arched in front. Branchiostegals 6. Gill membranes free from the isthmus. Œsophagus not armed with spinous teeth. Air bladder large, bifurcate behind. Pyloric appendages very numerous. Vertebræ 45. Hypocoracoid very much dilated as in *Brama*, the entire shoulder girdle very heavy; the pubic bone much longer than in *Brama*. Fishes of large size and gorgeous coloration, inhabiting the open seas, the flesh firm and rich. A single genus with probably but one species. It resembles the tunnies in the character of the flesh, but the form is very different, and the character of the anal fins separates it widely from all the mackerel-like fishes. It is not certain that it really belongs with the *Scombroidei*. (*Scombridæ*, genus *Lampris*, Günther, Cat., II, 415, 416, 1860.)

## 434. LAMPRIS, Retzius.

(MARIPOSA.)

*Lampris*, RETZIUS, Nya Handlung, III, 91, 1799, (*guttatus*).
*Chrysotosus*, LACÉPÈDE, Hist. Nat. Poiss., IV, 586, 1802, (*luna*).

Characters of the genus included above. The single species is cosmopolitan, most beautifully colored, and unsurpassed as food, the flesh rich, firm, and delicate. (*λαμπρός*, radiant.)

### 1354. LAMPRIS LUNA* (Gmelin).

(MARIPOSA; OPAH; MOONFISH; SAN PEDRO FISH; CRAVO; JERUSALEM HADDOCK; GLANCE FISH; GUDLAX; POISSON LUNE.)

Head 3¼; depth 1¾. D. 53 to 55; A. 38 to 41; V. 14 to 17; vertebræ 23 + 22 = 45. Body short and very deep, the sides much compressed. Mouth toothless. Longest dorsal ray shorter than pectorals, which are nearly as long as the head. Anal very low in front, a little higher behind. Color a rich brocade of silver and lilac, rosy on the belly; everywhere with round silvery spots; head, opercles, and back with ultramarine tints; jaws and fins vermilion; flesh red, of varying shades. Skeleton strong and firm. Length 3 to 6 feet. Open waters of the Atlantic and Pacific, frequently taken off the Coasts of Europe; not rare off Madeira, occasionally taken off Newfoundland, Maine, and Cuba, also at Monterey and other places in California. Our specimen is from Monterey. One of the choicest of fishes, the flesh rich, firm, and of delicate flavor. (*luna*, moon.) (Eu.)

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*We have before us a drawing of a specimen of *Lampris luna* made at Sable Island by James Farquhar in 1856, and sent with an accompanying letter to Dr. J. Bernard Gilpin of Halifax. Mr. Farquhar writes: "Just imagine the body a beautiful silver, interspersed with spots of a lighter color about the size of a sixpence, the eyes very large and brilliant, with a golden ring around them. You will then have some idea of the splendid appearance of the fish when fresh. If Caligula had seen him I might have realized a fortune.

*Zeus luna*,* GMELIN, Syst. Nat., XIII, 1225, 1788, Normandy; after Poisson de Lune, DU HAMEL, Des Pêches, III, 74.

*Zeus guttatus*,* BRÜNNICH, Danske Selskr., III, 398, 1788, Elsinore, Denmark.

*Zeus regius*,* BONNATERRE, Encycl. Ichth., 72, pl. 39, 1788, Torbay, England; after Opah of PENNANT.

*Zeus strœmii*, WALBAUM, Artedi Piscium, 398, 1792, Norway; after *Zeus cauda bifurca* of STRÖM.

*Scomber gunneri*, BLOCH & SCHNEIDER, Syst. Ichth., 38, 1801; after *Scomber pelagicus* of GUNNER; specimens from near Throndhjem.

*Zeus imperialis*, SHAW, Nat. Misc., IV, 140, 1803, Torbay; after Opah of PENNANT.

*Zeus opah*, SHAW, Genl. Zoöl., IV, 287, 1803, Torbay; after PENNANT.

*Lampris lauta*, LOWE, Fishes Madeira, 27, 1843, Madeira.

*Lampris guttatus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., x, 39, pl. 282, 1835; JORDAN & GILBERT, Synopsis, 453, 1883.

*Lampris luna*, GÜNTHER, Cat., II, 416, 1860; DAY, Fish. Great Britain 118.

*Lampris regius*, GOODE & BEAN, Oceanic Ichth., 223, 1895.

## Family CXXXI. PTERACLIDÆ.

Dorsal fin very high, continuous, with its rays all simple, not articulate nor branched; anal similar to dorsal; ventrals jugular, inserted before pectorals, about under the eye, their rays I, 3 or I, 5; scales firm, lobate or emarginate; dorsal and anal each with a basal sheath of enlarged scales, the fin otherwise naked. Otherwise essentially as in the *Bramidæ*. Skeleton not examined, the vertebræ probably numerous, the attachment of the ventrals to the shoulder girdle evidently unlike that seen in the *Bramidæ*. Two genera, with about 5 species; small pelagic fishes, notable for the very high fins.

*a.* †Ventral rays I, 3; lateral line faint, but present; dorsal beginning on head, its short rays few (about 2 or 3) in number, the third or fourth ray longest; teeth on vomer and palatines. PTERACLIS, 435.

## 435. PTERACLIS, Gronow.

*Pteraclis*, GRONOW, Acta Helvetica, VII, 44, 1772, (*velifera*).

*Oligopodus*, LACÉPÈDE, Hist. Nat. Poiss., II, 512, 1800, (*velifera*).

Body oblong ovate, much compressed, deep anteriorly, growing rapidly and regularly slender behind; scales rather large, firm, each one with a median horizontal furrow or emargination, these forming distinct striated lines along the rows of scales. Lateral line not obsolete. A sheath of very large scales along bases of dorsal and anal; a long axillary scale at base of ventral; scales on head and breast small. Caudal peduncle slender, the caudal fin short, lunate. Vent nearly under preopercle, the breast very short. Abdominal cavity extending much behind vent, as in the flounders. Ventrals jugular in position, directly under the eye, each of a feeble spine and about 3 soft rays. Pectorals moderate.

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*We have no means of knowing which of the three specific names given to this species in 1788, *luna*, *guttatus*, *regius*, is entitled to priority. We have elsewhere regarded the names of Gmelin as prior to those of Bonnaterre, and we know of no reason for supposing the work of Brünnich to be earlier than either. The still earlier name *pelagicus*, given by Gunner, is an error of identification, the *Scomber pelagicus* of Linnæus being a *Coryphæna*.

† The Japanese genus, *Centropholis*, Hilgendorf, has the ventral rays I, 5; lateral line obsolete; dorsal beginning behind head, with about 13 graduated rays, the fourteenth ray longest; no teeth on vomer or palatines. The type is *Centropholis petersi*, Hilgendorf.

Dorsal fin excessively high, all the rays alike, simple, fragile, and unbranched, appearing like hairs; some of the anterior rays higher; 2 or 3 of the anterior shorter and graduated; the posterior rays progressively shorter; first dorsal ray on the head. Anal similar to dorsal, equally high and almost as long, the rays all simple, the first ray short. Eye large; nape elevated; mouth large, nearly vertical; maxillary broad, scaly; teeth small, slender, on jaws, tongue, vomer, and palatines. Pseudobranchiæ present; air bladder small; cœca 6. Pelagic fishes, widely distributed. (*πτερόν*, fin or wing; *κλείω*, to close. "The name indicating the double rows of scales which embrace the bases of the two vertical fins.")

### 1355. PTERACLIS CAROLINUS, Cuvier & Valenciennes.

D. LII; A. XLIV. Mouth larger, scales larger, and fourth or longest ray of the dorsal stouter than in other species. Silvery, with bluish reflections. Coast of South Carolina; known from a mutilated specimen 4 inches long, evidently the young of some pelagic species. (Cuv. & Val.) A second specimen, agreeing in general with this description has been lately obtained by the *Albatross* (Goode & Bean).

*? Pteraclis trichopterus*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 367, 1833, locality unknown. D. 50; A. 44. (Coll. Quoy & Gaimard.)

*Pteraclis carolinus*, Cuvier & Valenciennes, *l. c.*, ix, 368, 1833, off coast of South Carolina, Günther, Cat., ii, 411, 1860; Jordan & Gilbert, Synopsis, 455, 1883; Goode & Bean; Oceanic Ichthyology, 212, 1895.

## Family CXXXII. BRAMIDÆ.

### (The Pomfrets.)

Body oblong, more or less elevated, strongly compressed, covered with firm adherent scales, large or small. Scales firm, cycloid, lobate, or emarginate, or with a median ridge or spine; this character found in the young of all species but disappearing with age in some of them. Mouth moderate, very oblique, the maxillary broad and scaly, the premaxillary protractile; jaws with bands of slender teeth; teeth on vomer and palatines present or absent. Preopercle entire or serrulate, serrate or spinous in the young; opercles well developed. Dorsal and anal fins long, similar to each other; each with 3 or 4 anterior rays short and simple, developed as spines, the remaining rays all articulated; soft dorsal and anal scaly or with a sheath of scales; ventrals small, below the pectoral; the axillary scale well developed, the rays I, 5. Pectoral long. Caudal peduncle slender, the fin lunate or forked, sometimes widely so. Branchiostegals 7. Pseudobranchiæ present. Pyloric cœca few. Air bladder present or absent; supraoccipital crest large and high, extending forward to the snout. Vertebræ numerous (16 + 23 = 39 in *Brama raii*). Skeleton firm. Shoulder girdle thick and heavy, the hypocoracoid especially large and much dilated, entering the ventral outline, excluding the pubic bones from contact with the shoulder girdle; pubic bones short and small; neurals and interneurals small and slender. Fishes of the open sea, widely distributed and often inhabiting considerable depths, subject to great changes with age. Genera 3 (*Brama*, *Taractes*, *Pterycombus*) with about 10 species. (*Scombridæ*, part, Günther, Cat., II, 408–411, 1860.)

*a.** Dorsal fin beginning at a point behind the gill opening.
  *b.* Scales large (40 to 50 in lengthwise series); lateral line obsolete; each scale deeply emarginate and with a median horizontal ridge (as in *Pteraclis* and the young of *Brama*); this character persistent through life; soft fins chiefly scaly at base and on the anterior lobe; ventrals inserted before pectorals. TARACTES, 436.
  *bb.* Scales small (about 80 in lateral line) those of sides with a long bony vertical ridge and a narrow cycloid free part, which conceals the ridge in the adult; lateral line developed; soft fins almost entirely scaly; ventrals inserted below pectorals. BRAMA, 437.

## 436. TARACTES, Lowe.

*Taractes*, LOWE, Proc. Zoöl. Soc. Lond., 1863, 82, (*asper*, probably young of *Brama* or *Taractes longipinnis*).

*Argo*, DODERLEIN, in Steindachner's Fische Japan, III, 7, 1884, (*steindachneri*); name preoccupied in Mollusks, by Bohadsch, 1761.

Body ovate, compressed, the nape less elevated than in *Brama*, the back more so; scales large, firm, deeply emarginate and with a horizontal median ridge or spine, as in the young of *Brama*, this character persistent; no lateral line; dorsal and anal more or less falcate, the spines few and slender, adnate to the soft rays; scales on the fins largely confined to the anterior lobe; ventrals small, inserted before pectorals. Caudal simply lunate, on a slender peduncle. A well-marked genus intermediate between *Pteraclis* and *Brama*. The large scales (lateral line 43) of *Taractes asper*, show, as Dr. Lütken has indicated, that it is the young of *Brama longipinnis*, rather than of *Brama raii*. This species, *longipinnis*, is very closely related to the Japanese form called *Argo steindachneri*. The name *Taractes* may therefore supersede *Argo*, which is preoccupied. (*ταράκτης*, a disturber.)

### 1356. TARACTES SAUSSURII (Lunel).

Head 4⅕ in total length; depth 2½. D. III, 30; A. II, 20; V. I, 5; B. 7; scales 50. Body compressed, elevated; back and belly slightly keeled; line of profile strongly elevated toward front of dorsal, thence descending gradually to the forehead, where it is abruptly decurved in a semicircle. Eye large, 3 in head. Mouth oblique, the maxillary nearly reaching posterior margin of eye. Dorsal beginning behind base of pectoral, its length of base equal to height of body; second soft ray longest, nearly ⅓ of height of body; anal inserted below fourteenth dorsal ray, its first soft ray ¼ depth of body; pectoral reaching twelfth soft ray of dorsal; ventral under base of pectoral, its first ray ¼ height of body. Silvery and gray; the dorsal, from its first soft ray to the ninth, broadly bordered with white, the rest of the fin with black; first 7 rays of anal perfectly white, the next 4 bordered with white, the rest of the fin blackish; both lobes of caudal broadly bordered with white, the 6 middle rays blackish; pectorals and ventrals yellowish. Each scale of sides (in specimen 12 inches long) with a spinous ridge along its middle. (Lunel.) Havana. One specimen in the museum at Geneva. It is evidently a *Taractes*, but with the fins much lower than in *Taractes longipinnis*. (Named for Prof. Henri de Saussure, of Geneva, a writer on crustacea, insects, etc.

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* Dorsal beginning on the head above the preopercle in *Pterycombus*, Fries. *Pterycombus brama*, Fries, the known species of this genus, is thus far known from Iceland, Norway, and neighboring waters. It doubtless occurs in Greenland waters.

*Brama saussurii*, LUNEL, Revue du Genre Brama, Mem. Soc. Phys. Hist. Nat. Genève, XVIII, 185, pl. 2, 1865, Cuba; POEY, Synopsis, 358, 1868.

## 437. BRAMA,* Bloch & Schneider.

### (POMFRET.)

*Brama*, BLOCH & SCHNEIDER, Syst. Ichth., 98, 1801, (*raii*).
*Lepodus*, RAFINESQUE, Caratteri, etc., 53, 1810, (*saragus*).

Body oblong or elevated, compressed, covered with rather small cycloid scales, each of which is usually composed of a bony ridge or spine, with a cycloid free edge, the bony vertical portion often becoming hidden with age. Mouth wide, oblique, the lower jaw the longer; the jaws and palatines provided with slender teeth; maxillary broad, scaly. No teeth in the œsophagus. Opercle moderately developed; preopercle entire, serrulate in the young. Snout obtuse and convex, supraoccipital crest highly elevated, extending forward to tip of snout. Dorsal and anal fins very long, both with the anterior lobe more or less elevated, the first ray of dorsal over the ventrals and notably behind the head; a few (3 or 4) of the anterior rays developed as slender graduated spines; ventrals small, thoracic, the number of rays I, 5. Soft parts of vertical fins covered with small scales except along the edge. Pyloric cœca 5; branchiostegals 7; vertebræ about 40; pseudobranchiæ large; air bladder large. Shoulder girdle very heavy, as in *Lampris*, the hypocoracoid especially thick and large, excluding the small pelvis from contact with the clavicle. Neurals and interneurals comparatively small. Large pelagic fishes of dusky colors, widely distributed and descending to considerable depths, the adult quite unlike the young. (*Brama*, bream, *Abramis*, the species having been called *Brama marina* by John Ray.)

*a.* Dorsal rays about III, 30; anal rays II, 19 or 20; caudal not deeply forked.
  *b.* Caudal fin bordered with white (as in *Taractes*), its middle rays not salient; longest dorsal rays more than half depth of body. AGASSIZII, 1357.
  *bb.* Caudal fin without whitish border, its middle rays somewhat salient; longest dorsal rays $\frac{2}{3}$ depth of body. BREVOORTII, 1358.
*aa.* Dorsal rays III, 31 to 33; anal rays II, 26 or 27; scales in lateral line 80 to 90; longest dorsal rays about half depth of body; caudal very deeply forked, its middle rays not salient. RAII, 1359.

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* A very elaborate study of *Brama* has been completed by Lütken, based upon a large series, chiefly of young specimens. Concerning *B. raii* he concludes that it is quite cosmopolitan in its distribution, occurring from the Faröe Islands to the Cape of Good Hope, and is represented by closely similar, if not identical, forms on the coast of Chile (*B. chilensis* and *australis*) and New Zealand (*B. squamosa*) and in the waters of Japan. He states that it has not yet been found in the West Indies or off the east coast of North America, overlooking, perhaps, the fact that *Brama raii* was observed at the Bermudas in 1880 by Dr. Goode. He considers *B. orcini* and *B. dussumieri* and *Taractes asper* to be immature forms and gives a very doubtful acceptance to six species, claiming to be distinct from *B. raii*, described from various parts of the Atlantic.—(*Goode & Bean.*)

*Brama raii* is not unfreqently taken on the coasts of California, Oregon, and Washington. *Taractes asper* is, however, not the young of *Brama raii*, but belongs to a distinct genus.

### 1357. BRAMA AGASSIZII, Poey.

Head 4½ in total with caudal; depth 3. D. III, 29; A. II, 21. Number of scales not stated, probably about as in *B. raii.* Eye 3½ in head (in specimen 2 feet long); maxillary reaching past middle of eye. Jaws with bands of villiform teeth, those in front larger; no canines; villiform teeth on the palatines; two strong teeth on the vomer. Form of the scales about as in *B. raii,* their free border thin and not ciliated, giving the effect of an epidermal membrane attached to each scale and reflecting a dull silvery color. Longest ray of dorsal a little more than half depth of body; anal inserted under thirteenth ray of dorsal; ventrals twice as short as pectorals; caudal concave, its middle rays not at all produced. Air bladder large; vertebræ more than 24. Dusky, with bright reflections; caudal largely bordered with whitish. Cœca 7. Cuba; known from one specimen. (Poey.) Apparently allied to *Brama raii,* but the fins are shorter. (Named for Louis Agassiz.)

*Brama agassizii,* Poey, Memorias, II, 204, 1860, Havana.

### 1358. BRAMA BREVOORTII, Poey.

Head 4½ in total length with caudal; depth 2⅔. D. III, 27 (or III, 30); A. II, 21. Eye 3¾ in head, (in specimen 16 inches long). Teeth as in *Brama agassizii,* but none on vomer. Second ray of dorsal ⅖ height of body; anal inserted much farther back than front of dorsal. Scales as in *Brama agassizii.* Caudal blackish, without pale margin, its middle rays salient, half the length of the outer; pectorals shorter than in other species; fins higher than *B. raii,* lower than in *B. agassizii.* Cœca 8. Color as in *B. agassizii,* except the caudal. Havana, Cuba; known from one specimen. (Poey.) (Named for James Carson Brevoort.)

*Brama brevoortii,* Poey, Memorias, II, 206, 1860, Havana.

### 1359. BRAMA RAII (Bloch).

(Pomfret; Castagnole; Rondanin.)

Head 3⅔; depth 2⅓. D. III, 32; A. II, 27; scales 13-80-23. Pyloric cœca 5. Vertebræ 16 + 24 = 40. Eye large, 4 in head, as long as snout. Maxillary 2⅕ in head. Teeth on palatines, none on vomer. Scales of sides of body in adult much elongate vertically, consisting of a long vertical bony portion which is sharp at either end and does not appear at the surface; this projection extends under each scale above and below for a distance nearly equaling diameter of the visible part of the scale; this free part forming a cycloid lobate flap deeper than long; axil with a fringe of long scales attached by one edge; scales of back and belly smaller, nearly normal in form; fin rays of anterior part of dorsal, each with a scaly flap free at one edge. Maxillary and opercles scaly; lower jaw with rudimentary scales. Pectorals long, falcate, reaching middle of anal, 2⅔ in body; dorsal and anal high in front, but lower than in *Brama agassizii,* the longest rays about 2½ in depth of body, 5¼ in length of body; caudal fin on a slender peduncle, deeply forked, its middle rays not salient, its longest rays 3¾ in body. Gill rakers moderate, x + 13. Color sooty gray, with some soiled silvery; snout, vertical fins, and region above anal black; edges of dorsal and anal darker; axil jet black within. Bones firm. Length 2 to 4 feet. Open seas, widely distributed, descending to considerable depths; occasional on the coasts of Europe as far north as the Faröe Islands, rarely taken on our Atlantic Coast. Bermuda (Goode); Grand Bank (Bean). It has lately been frequently obtained on our Pacific Coast in different localities from Santa Catalina to Puget Sound. Here described from a specimen found in the Los Angeles market. In our specimen the pectoral is a little longer and the scales a little larger than in Day's figure of the European form, but doubtless the same species. Many of the known specimens have been beached by storms. An excellent food-fish. (Named for Rev. John Ray, a learned naturalist, one of the ablest of the predecessors of Linnæus.) (Eu.)

*Brama marina cauda forcipata*, RAY, Synopsis Methodica Piscium, 115, 1713, Middelburg.

*Sparus raii*, BLOCH, Ichthyol., pl. 273, 1791; after RAY, etc.

*Sparus castaneola*, SHAW, Gen. Zoöl., IV., 404, 1803; after LACÉPÈDE, who copied from BLOCH.

*Sparus niger*, TURTON, British Fauna, 98, 1807, Swansea.

*Lepodus saragus*, RAFINESQUE, Caratteri, etc., 53, 1810, Palermo.

*Brama dussumieri*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., VII, 294, 1831, Indian Sea, Longitude 85° E.

? *Brama orcini*, CUVIER & VALENCIENNES, *l. c*, VII, 295, 1831, Indian Sea, Longitude 85° E.; from stomach of *Germo alalunga*.

? *Brama chilensis*, GAY, Hist. Chili, Peces, 218, 1843, Chile.

*Brama raii*, VALENCIENNES IN CUVIER, Règne Anim., Illustr. Poiss., pl. 26, fig. 1, 1839, Chile; after GAY'S type.

*Brama raji*, BLOCH & SCHNEIDER, Syst. Ichth., 99, 1801; JORDAN & GILBERT, Synopsis, 915, 1883.

*Brama raii*, GÜNTHER, Cat., II, 408, 1860; LÜTKEN, Spolia Atlantica.

## Family CXXXIII. STEINEGERIIDÆ.

Dorsal fin low, divided by a deep notch into an anterior part of about 11 slender spines and a posterior part of about 18 soft rays; scales moderate, each with a median keel; ventrals I, 5, inserted before pectorals, otherwise essentially as in the *Bramidæ*, so far as external characters show. The true relation of the group remains to be shown from a study of the skeleton. One species known, from rather deep water.

### 438. STEINEGERIA, Jordan & Evermann.

*Steinegeria*, JORDAN & EVERMANN, Proc. U. S. Nat. Mus., 1886, 467, (*rubescens*).

Body ovate, considerably compressed, thickly covered with rather large membranous scales, which are closely imbricated, and each with a distinct median keel. Cleft of mouth very oblique, the lower jaw strongly projecting. Jaws with bands of small cardiform teeth, those in front largest, especially in the lower jaw; teeth in villiform bands on the palatines, but absent from the vomer. Premaxillaries protractile; preopercle without angle, with ascending limb finely serrulate, and with a few coarser teeth about the angle. No distinct lateral line. Dorsal and anal fins somewhat elongate, the former deeply notched, with 11 slender spines, the latter with 2 spines; caudal lunate, with short and slender peduncle; ventrals I, 5, inserted before pectorals, not depressible in a groove, each with 1 spine and 5 rays. Vent well behind ventrals. A single species known, from the Gulf of Mexico. Its skeleton has not been examined. It is therefore not known how close its relations to *Brama* may be, but it cannot be removed far from that group. Its divided dorsal suggests relations with *Nomeus*, but the scales are more like those of *Brama*. (Named for Leonhard Stejneger, curator of reptiles in the United States National Museum, one of the ablest systematic zoologists of our time.)

### 1360. STEINEGERIA RUBESCENS, Jordan & Evermann.

Head 2⅔; depth 2; snout short, 5 in head. D. XI–I, 18; A. II, 20; V. I, 5; scales 50–26. Body ovate, considerably compressed, the greatest thickness a little less than half length of head. Anterior profile from tip of snout to base of dorsal nearly straight; outline of belly prominent, the axis of body being rather nearer dorsal than ventral outline; breast and belly not carinate. Head but little longer than deep, its upper surface flattish, the bones not very firm; interorbital space nearly flat, with 2 ridges about as broad as eye, which is 3⅓ in head; preorbital very narrow, somewhat cavernous, its edge sharply dentate; mouth very oblique, the lower jaw strongly projecting, the broad maxillary reaching to below middle of eye, its length ½ that of the head. Each jaw with a band of small cardiform teeth, those in front largest, especially in the lower jaw, but all of them small; a band of villiform teeth on each palatine bone, but none on the vomer; premaxillaries protractile. Lower jaw with conspicuous pores; preopercle forming a nearly even curve, without distinct angle; ascending limb of preopercle very finely serrulate, with some 4 or 5 coarser teeth about the angle; other opercular bones very thin, with entire edges. Cheeks, opercles, maxillary, and top of head closely covered with scales similar to those on rest of body, but a little smaller. Gill rakers rather short and wide apart, 8 or 9 developed on the lower part of the arch, the longest about ⅓ length of eye. Body closely covered with membranous scales, which are closely imbricated, deeper than long, each with a distinct median keel, besides which are some smaller radiating ridges, especially on the scales of the sides of the body. These ridges on the scales form continuous ridges, which give the body a rough appearance, although they are not spinigerous; scales largest on middle of sides, becoming smaller on back and on belly; no distinct lateral line; fins with few scales or none. Dorsal spines very slender and flexible, some of them ending in filaments (all more or less mutilated in typical example); soft rays separated from spines by a deep notch extending nearly to base of fin; soft dorsal elevated, the longest rays about 1⅓ in head; caudal lunate, its peduncle very short and slender; anal fin high, its spines short and slender, the longest ray 1⅓ in head; no free anal spines; ventrals inserted before pectorals, their length 1⅕ in head, not depressible into a fissure of the abdomen; pectorals 1⅓ in head; vent well behind ventrals. Color in life salmon red, rather bright and nearly uniform, darker on back, silvery under the chin; fins all salmon, with black areas toward base on both dorsals and anal; ventrals largely black; lining of opercles pale. Length 5 inches. A single specimen, in fair condition, was found in the stomach of a Red Grouper from the Snapper Banks off Pensacola. (*rubescens*, reddening.)

*Steinegeria rubescens*, JORDAN & EVERMANN, Proc. U. S. Nat. Mus., 1886, 467, Snapper Banks off Pensacola. (Type, No. 37991. Coll. Jordan & Evermann.)

## Family CXXXIV. CENTROLOPHIDÆ.

### (THE RUDDER-FISHES.)

Body oblong or elongate, compressed, covered with moderate cycloid, adherent scales. Lateral line present, straightish. Bones of head sometimes serrulate. Mouth moderate, with small teeth. Premaxillaries protractile. Œsophagus with tooth-like processes as in *Stromateidæ*. Vertebræ in normal number, 10 + 14 or 15 = 24 or 25. Dorsal fin long, 3 to 10 of the anterior rays simple, more or less spine-like; anal similar, shorter; caudal lunate, on a rather stout peduncle; ventrals well developed, thoracic, I, 5. Skeleton moderately firm. Fishes of the open seas, inhabiting moderate depths. Three genera and about 6 species recognized. This group is closely related to the *Stromateidæ*, but seems worthy of separate recognition. (*Centrolophinæ*, GILL, Proc. Am. Phil. Soc., XXI, 666, 1884.)

CENTROLOPHINÆ:

- *a.* Dorsal spines slender, graduated, joined by the membrane; soft rays moderately elevated; head naked, its bones entire. CENTROLOPHUS, 439.

MUPINÆ:

- *aa.* Dorsal spines short and stout, subequal, about as long as soft rays; fins not falcate; sides of head scaly.
  - *b.* Eyes small; dorsal spines scarcely connected by membrane; preopercle, interopercle, and subopercle finely serrate. PALINURICHTHYS, 440.

## 439. CENTROLOPHUS, Lacépède.

### (BLACK RUFFS.)

*Centrolophus*, LACÉPÈDE, Hist. Nat. Poiss., IV, 441, 1803, (*niger*).
*Pompilus*, LOWE, Proc. Zoöl. Soc. Lond., 81, 1839, (*pompilus*).
*Acentrolophus*, NARDO, Prodr. Ichth. Adriat., sp. 62, (*maculosus*).
*Gymnocephalus*, COCCO, Giorn. Sci. Lettr. Sic., 26, 1829, (*messinensis*).

Body elongate, covered with minute scales; lateral line present, arched anteriorly. Head naked, unarmed. Mouth rather small, with small teeth in jaws only. Epibranchials of fourth gill arch with long, toothed processes as in *Stromateus*, *Rhombus*, *Mupus*,* and *Palinurichthys*. Dorsal long, continuous, not falcate, with about 3 slender, graduated spines. Dorsal and anal scaly; anal with 3 slender spines. Ventrals moderate, thoracic,

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* *Mupus*, Cocco = *Leirus*, Lowe, based on *Mupus imperialis*, Cocco = *Centrolophus ovalis*, Cuvier & Valenciennes.

I, 5. Pectorals moderate. Caudal forked. Air bladder small. Pyloric cœca 9 or 10. Three species known, from the Atlantic and Pacific. (*κέντρον*, spine; *λόφος*, crest.)

### 1361. CENTROLOPHUS NIGER (Gmelin).

(BLACKFISH; BLACK RUFFE; BORLASE.)

Head 5 in total length; depth 4 to 5. D. III, 35 to 38; A. III, 20 to 22; vertebræ 11 + 14; cœca 9. Maxillary reaching to below front of eye. Dorsal inserted above first third of pectoral. Scales minute, forming a sheath along basal third of vertical fins. Dark brown, clouded or spotted with paler. Coasts of southern Europe, not rare in rather deep water; one specimen, 9 inches long, taken at Dennis, Massachusetts, in 1888. (*niger*, black.) (Eu.)

*Perca nigra*, GMELIN, Syst. Nat., 1321, 1788, Cornwall.
*Centrolophus liparis*, RISSO, Eur. Mérid., III, 337, 1826, Nice.
*Centrolophus morio*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IX, 342, 1833, Mediterranean.
*Centrolophus pompilus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IX, 334, 1833; not of LINNÆUS, who describes some very different fish as *Coryphæna pompilus*.
*Acentrolophus maculosus*, NARDO, Prodr. Ichth. Adriat., No. 62, Isis, Col. 478, 1827, Adriatic.
*Centrolophus niger*, GÜNTHER, Cat. Fishes, II, 403; GOODE & BEAN, Ocean. Ichth., 214.

## 440. PALINURICHTHYS, Bleeker.

(BLACK RUDDER FISHES.)

*Palinurus*, DE KAY, New York, Fauna: Fishes, 118, 1842, (*perciformis*) (preoccupied in *Crustacea*.)
*Palinurichthys*, BLEEKER, Enum. Spec. Pisc. Arch. Ind., 22, November, 1859, (*perciformis*).
*Palinurichthys*, GILL, Proc. Ac. Nat. Sci. Phila., Jan., 1860,* 20, (*perciformis*).
*Pammelas*, GÜNTHER, Cat., II, 485, June, 1860, (*perciformis*).

Body oblong, ovate, moderately compressed. Profile very blunt and convex. Mouth moderate; maxillary narrow, with a small supplemental bone; premaxillaries protractile, little movable. Jaws nearly equal, each with about one series of small, slender teeth; no teeth on vomer or palatines. Preoperculum, interoperculum, and suboperculum finely serrated. Gill rakers long; gill membranes separate, free from the isthmus. Scales small, smooth; larger, thicker, and more adherent than in *Stromateus*. Cheeks scaly. Fins rather low; dorsal fin long, preceded by 6 to 8 short subequal, rather strong spines, the last ones connected by membrane, the others nearly free, all much lower than the soft rays; anal fin similar but shorter, preceded by 3 spines, which, like the dorsal spines, are nearly embedded in thick skin; vertical fins densely scaly toward their bases; caudal fin emarginate; caudal peduncle stout; ventral fins large, thoracic, I, 5; pectoral fins moderate, rounded, or falcate. One species, differing from the European genus *Mupus* Cocco (= *Leirus* Lowe) by the low, partly free spines, and the small eye. (*παλινοῦρος*, *Palinurus*, a pilot; *ἰχθύς*, fish.)

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* "The paper in the Proc. Acad. was probably published earlier than Dr. Bleeker's but, happily, the question is immaterial."—Gill, Proc. Amer. Philos. Soc., XXI, 667, 1884.

### 1362. PALINURICHTHYS PERCIFORMIS (Mitchill).

(Rudder-fish; Log Fish; Snip-nose Mullet.)

Head 3⅓; depth 2½. D. VIII, 20; A. III, 16; lateral line 75; eye rather large, nearly equal to snout, 4½ in head. Body ovate. Maxillary reaching to opposite front of pupil; eye with adipose eyelid. Top of head scaleless, covered with small mucous pores. Pectorals nearly as long as head. Blackish green, everywhere dark, the belly scarcely paler and not silvery. Length 1 foot. Atlantic Coast of North America, from Cape Hatteras to Maine; rather common northward, especially about Cape Cod; one specimen once taken in a live box off Cornwall, having drifted across from America. (*Perca*, perch; *forma*, shape.)

*Coryphena perciformis*, Mitchill, Amer. Monthly Mag., II, 244, 1818, New York Harbor.
*Pimelepterus cornubiensis*, Cornish, Zoölogist, IX, 1874, 4255, Penzance, in Cornwall. (Coll. T. Cornish.)
*Palinurus perciformis*, De Kay, New York Fauna: Fishes, 118, pl. 24, fig. 25, 1842.
*Palinurichthys perciformis*, Gill, Proc. Ac. Nat. Sci. Phila., 20, 1860.
*Pammelas perciformis*, Günther, Cat., II, 485, 1860.
*Lirus perciformis*, Jordan & Gilbert, Synopsis, 452, 1883; Fordice, Proc. Ac. Nat. Sci. Phila., 316, 1884.

## Family CXXXV. STROMATEIDÆ.*

(The Fiatolas.)

Body compressed and more or less elevated, covered with small or minute cycloid scales. Profile anteriorly blunt and rounded. Mouth small. Premaxillaries not protractile. Dentition feeble; no teeth on vomer or palatines; pharyngeals little developed; œsophagus armed with numerous horny, barbed, or hooked teeth. Opercular bones smooth, not serrate. Gills 4, a slit behind the fourth. Gill membranes either separate and free from (*Stromateinæ*) or broadly joined to the isthmus (*Stromateoidinæ*), restricting the gill openings to the sides as in *Chætodipterus*. Gill rakers rather long. Pseudobranchiæ present. Cheeks scaly. Preopercle entire or serrate. Lateral line well developed. Dorsal fin single, long, with the spines few or weak, often obsolete; anal fin long, similar to soft dorsal, usually with 3 small spines, which are often depressible in a fold of skin; ventrals thoracic, I, 5, in the young, but reduced or altogether wanting in the adult; caudal fin well forked. Usually no air bladder. Pyloric cœca commonly numerous. Vertebræ 30 to 36 (*Rhombus* 30 or 31; *Stromateus* 36). Genera 3, species about 30. Fishes usually of small size, found in most warm seas, many of them valued as food. We here remove the *Centrolophidæ*, a group usually associated with the *Stromateidæ*, but differing in appearance and in the smaller number of vertebræ, although agreeing in the possession of teeth in the œsophagus. (*Scombridæ*, part, Günther, Cat., II, 397, 1860, genus *Stromateus*.)

*a* Pelvic† bone projecting from the skin as an evident spine; no trace of ventrals.
Rhombus, 441.

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* For a review of the American species of *Stromateidæ* see paper by Fordice in Proc. Ac. Nat. Sci. Phila., 1884, 311–317.

† The pelvic bone is not externally visible in *Stromateus*.

## 441. RHOMBUS, Lacépède.

(BUTTER-FISHES.)

*Rhombus*, LACÉPÈDE, Hist. Nat. Poiss., II, 321, 1800, (*alepidotus*).
*Peprilus*, CUVIER, Règne Anim., Ed. 2, Vol. II, 213, 1829, (*longipinnis*).
*Poronotus*, GILL, Cat, Fish. E. Coast N. Amer., 1861, 35, not characterized, (*triacanthus*); Proc. Am. Phil. Soc., XXI, 670. 1884, (diagnosed).
*Palometa*, JORDAN & EVERMANN, new subgenus, (*palometa*).

Body ovate or suborbicular, strongly compressed, tapering into a slender caudal peduncle, which is not keeled or shielded. Head short, compressed, the profile obtuse. Mouth small, terminal, the jaws subequal. Premaxillaries not protractile. Jaws each with a single series of weak teeth. Scales very small, cyloid, silvery, loosely inserted, extending on the vertical fins. Opercular bones entire. Gill membranes separate, free from the isthmus; gill rakers moderate. Lateral line continuous, concurrent with the back. Dorsal fin long, more or less elevated in front, preceded by a few indistinct spines—usually one or more procumbent spines in front of dorsal and anal, each of these with a free point both anteriorly and posteriorly; anal fin similar to dorsal, or shorter, usually with three small spines; ventral fins wanting; a single small, sharp spine, attached to the pubic bone, occupying the place of the ventrals; pectorals long and narrow; caudal widely forked. Species few, mostly American. This genus differs from *Stromateus* chiefly in the prominence of the pelvic bone, which projects as a lamina beyond the skin. Species of *Stromateus* occur in Europe and South America, but none within our limits. (*ῥόμβος*, a rhomb or diamond, from the form of the body.)

RHOMBUS:
- *a.* Dorsal and anal fins very high in front, the anterior lobe falcate; body suborbicular.
  - *b.* Dorsal rays III, 45, anal rays III, 43. PARU, 1363.
  - *bb.* Dorsal rays about III, 40; anal rays about III, 39. XANTHURUS, 1364.
- *aa.* Dorsal and anal fins moderately elevated in front, the anterior lobe scarcely falcate.
  - PALOMETA (Spanish name from *Paloma*, a dove):
    - *c.* Sides of back without conspicuous series of pores above lateral line.
      - *d.* Anal rays III, 45; body ovate, the depth half its length. PALOMETA, 1365.
      - *dd.* Anal rays III, 32 to 39.
        - *e.* Body broad ovate, the depth rather more than half the length; A. III, 32. MEDIUS, 1366.
        - *ee.* Body elliptical, the depth not half the length; A. III, 39. SIMILLIMUS, 1367.
  - PORONOTUS (*πόρος*, pore; *νῶτος*, back):
    - *cc.* Side of back above lateral line with a series of large, wide-set pores.
      - *f.* Body elliptical, the depth 2⅓ in length; anal rays III, 37. TRIACANTHUS, 1368.

### Subgenus RHOMBUS.

### 1363. RHOMBUS PARU (Linnæus).

(HARVEST FISH.)

Head 3; depth 1½. D. III, 45; A. II, 43; scales about 90; vertebræ 15 + 15. Body suborbicular, bounded by even curves; mouth very small, oblique; maxillary reaching front of orbit. No pores along sides of back. Dorsal and anal fins falcate, the length of their longest rays greater than head; pectorals much longer than head, reaching halfway to caudal; caudal lobes equal; scales thin and deciduous, not very small. Pelvic spine crenulate in young. Greenish above, golden yellow below. Length 6 inches. South Atlantic Coast of United States and West Indies; not rare southward, ranging from Cape Cod to Jamaica, and also to Brazil; often found swimming beneath the Portuguese man of war with *Nomeus gronovii*. (*Paru*, a Brazilian name of a species of *Pomacanthus*.)

*Paru Brasiliense congener*, SLOANE, Jamaica, 285, 1727.

*Stromateus paru*, LINNÆUS, Syst. Nat., Ed. X, 1758, 248, Jamaica (based on SLOANE); JORDAN & GILBERT, Synopsis, 914, 1883; FORDICE, *l. c.*, 312, 1884.

*Chætodon alepidotus*, LINNÆUS, Syst. Nat., Ed. XII, 460, 1766, Charleston. (Coll. Dr. Garden.)

*Sternoptyx gardenii*, BLOCH & SCHNEIDER, Syst. Ichth., 494, 1801, Carolina; after LINNÆUS.

*Stromateus longipinnis*, MITCHILL, Trans. Lit. and Philos. Soc. New York, I, 1815, 366, New York Bay.

*Rhombus alepidotus*, LACÉPÈDE, Hist. Nat. Poiss., II, 321, 1800.

*Rhombus longipinnis*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IX, 401, pl. 274, 1833.

*Stromateus gardenii*, GÜNTHER, Cat., II, 399, 1860.

*Stromateus alepidotus*, LÜTKEN, Spolia Atlantica, 521, 1880; JORDAN & GILBERT, Synopsis, 451, 1883.

### 1364. RHOMBUS XANTHURUS (Quoy & Gaimard).

Allied to *Rhombus paru*, but perhaps distinguished by the shorter dorsal and anal. D. IV, 40; A, III, 39. East coast of South America, Cayenne to Montevideo; not seen by us; perhaps not distinct from *Rhombus paru*. (*ξανθός*, yellow; *σὐρά*, tail.)

*Seserinus xanthurus*, QUOY & GAIMARD, Voy. Freyc., Zoöl., 384, 1824, Brazil.

*Rhombus argentipinnis*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IX, 405, 1833, Montevideo.

*Rhombus crenulatus*, CUVIER & VALENCIENNES, *l. c.*, IX, 410, 1833, Cayenne.

*Rhombus orbicularis*, GUICHENOT, Mem. Soc. Imp. Sci. Natur. Cherbourg, XII, 245, 1866, Cayenne.

## Subgenus PALOMETA, Jordan & Evermann.

### 1365. RHOMBUS PALOMETA (Jordan & Bollman).

Head 2¾ to 3; depth 2; snout shorter than eye, 4½ in head; eye rather large, 3 to 3½ in head (young). D. III, 45 to 47; A. III, 45. Body ovate, compressed, rather deeper than in *R. triacanthus*; ventral outline most arched; profile evenly convex to nostrils, where it abruptly descends, rendering the snout very blunt. Mouth small; maxillary reaching middle of pupil, 3 in head. Jaws equal. Teeth comparatively long, slender, and close set, especially in the lower jaw, where they form an even cutting edge. No teeth evident on vomer or tongue. Gill membranes entirely separate. Gill rakers long and slender, the longest about half eye, about 17 developed below angle. Dorsal and anal spines subequal, the longest not half eye; distance from tip of snout to first soft ray of dorsal less than depth of body by ⅔ diameter of eye; base of anal slightly shorter than base of dorsal (perhaps longer in adult); pectorals as long as head; no trace of ventrals, the pubic bone ending in a sharp spine; the usual antrorse spines before the dorsal. Region above lateral line without evident pores. Cheeks scaly; opercles naked; body covered with very small scales. Color silvery, bluish above; body with numerous, small, black dots, which are most numerous along bases of fins, caudal peduncle, top of head, and on snout, and largest along base of anal; vertical fins covered with small black dots, those on caudal smallest; pectorals dotted. Length 3 inches. Pacific Ocean, off Colombia. Length 2¾ inches. (*Palometa*, Spanish name of these fishes, from *Paloma*, dovo.)

*Stromateus palometa*, JORDAN & BOLLMAN, Proc. U. S. Nat. Mus., 1889, 156, off Coast of Colombia, latitude 8° 16′ 30″ N., longitude 79° 37′ 45″ W.; Albatross Station, No. 2804. (Type, No. 41136. Coll. Albatross).

### 1366. RHOMBUS MEDIUS (Peters).

(PALOMETA.)

Head 3½; depth $1\frac{9}{10}$; pectoral 2⅚ in body; dorsal lobe 4⅙; caudal 2⅘. D. III, 42; A. III, 32. Form broad, ovate. Fins distinctly punctulate. Length 7½ inches. Otherwise essentially as in *Rhombus simillimus*. Pacific Coast of North America, Mazatlan to Panama, scarce. This species is now known only from the original type in the museum at Berlin. In 1882, numerous specimens were collected at Panama by Dr. Gilbert, all of which have since been destroyed by fire. (*medius*, midway.)

*Stromateus medius*, PETERS, Berliner Monatsberichte, 707, 1869, Mazatlan; JORDAN, Proc. Ac. Nat. Sci. Phila., 1883, 284; FORDICE, *l. c.*, 314, 1884.

### 1367. RHOMBUS SIMILLIMUS (Ayres).

(CALIFORNIA POMPANO.)

Head 4; depth 2. D. III, 46; A. III, 40. Body ovate, blunt anteriorly, with a short, slender tail, the caudal fin widely forked. Mouth very small, terminal, the maxillary extending to the eye. Teeth very feeble. Gill rakers short, slender, less than half diameter of eye. Eye small. One or 2 procumbent spines before the dorsal; longest rays of dorsal ¾ of head; pubic spine small; pectorals longer than head; no pores along base of dorsal. Spines of dorsal and anal very small or entirely obsolete. Scales small, silvery, deciduous. Bluish above. bright silvery below; fins punctulate; anterior lobes of dorsal and anal dusky-edged. Length 10 inches. Pacific Coast of the United States, Puget Sound to San Diego; abundant in summer, especially about Santa Cruz; highly prized as a food-fish, its flesh being rich and delicate. (*simillimus*, very similar, to *Rhombus triacanthus*.)

*Poronotus simillimus*, AYRES, Proc. Cal. Ac. Nat. Sci., 1860, 84, San Francisco.
*Stromateus simillimus*, JORDAN & GILBERT, Synopsis, 451, 1883; FORDICE, *l. c.*, 314, 1884.

## Subgenus PORONOTUS, Gill.

### 1368. RHOMBUS TRIACANTHUS (Peck).

(DOLLAR-FISH; HARVEST-FISH; BUTTER-FISH; LA FAYETTE.)

Head 4; depth 2⅓; eye 4. D. III, 45; A. III, 38. Body oval, much compressed. Dorsal and ventral outlines about equally curved. Snout very blunt, rounded in profile. Mouth small, the maxillary not reaching orbit. Caudal peduncle very short; anterior rays of dorsal and anal little elevated. Lateral line high, a series of conspicuous pores above it near the base of dorsal. Pectorals much longer than broad. Gill rakers rather long, ⅔ diameter of eye. Bluish above, silvery below. Length 10 inches. Maine to Florida; very abundant northward; rare, and found in deep water south of Cape Hatteras; an excellent pan-fish of fine flavor, though less highly valued than its California congener, which it closely resembles. (*τρείς*, three; *ἄκανθα*, spine.)

*Stromateus triacanthus*, Peck, Mem. Amer. Ac., II, part 2, 48, pl. 2, fig. 2, 1800; Piscataqua River, New Hampshire; Jordan, & Gilbert, Synopsis, 451, 1883; Fordice, *l. c.*, 313, 1884.

*Stromateus cryptosus*, Mitchill, Trans. Lit. & Philos. Soc. N. Y., I, 1814, 365, plate 1, fig. 2, New York Bay; Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 408, 1833.

*Rhombus triacanthus*, De Kay, N. Y. Fauna: Fishes, 137, plate 26, 1842.

## Family CXXXVI. ICOSTEIDÆ.

### (The Rag Fishes.)

Body oblong, compressed, naked, prickly, or covered with small cycloid scales. Head moderate, not externally bony, the opercles unarmed. Mouth moderate, terminal; premaxillary not protractile; maxillary moderate, without supplemental bone. Teeth small, in single series; vomer and palatines without teeth; no teeth in the throat or on the pharyngeals (in *Icosteus* or *Acrotus*). No barbels. Lower pharyngeals separate. Branchiostegals 6. Gill openings wide, the membranes free from the isthmus; gills 4, a slit behind the fourth; gill rakers slender. Pseudobranchiæ large. Pyloric cœca few. Air bladder present. Lateral line present. Dorsal fin very long, continuous, without distinct spines; anal long, without spines; caudal fin convex, its peduncle slender; ventral fins thoracic, separate, but very close together, I, 4, or I, 5, wanting in one genus; pectorals rounded, fleshy at base; vent normal, without papilla. Skeleton very soft and cartilaginous. Vertebræ in large number. This group, as at present constituted, is composed of 4 quite diverse genera, inhabiting the deeper waters of the Atlantic and Pacific. Dr. Gill unites *Icosteidæ* with the *Stromateidæ*. The reason of this association is not evident, as the peculiar throat dentition seen in the *Stromateidæ* does not occur in *Icosteus* or *Acrotus*. The *Icosteidæ* show affinities with *Centrolophus*, but apparently their recognition as a distinct family is justified.

Schedophilinæ:

- *a.* Body covered with small, cycloid scales; no prickles; ventrals I, 5; caudal rounded or subtruncate.
  - *b.* Body elongate, not compressed at bases of vertical fins. Icichthys, 442.
  - *bb.* Body ovoid, strongly compressed, especially at bases of vertical fins. Schedophilus, 443.
- *aa.* Body scaleless; ventral fins, if present, with the number of rays less than I, 5.

Icosteinæ:

- *c.* Ventral fins present; caudal rounded.
  - *d.* Ventral rays I, 4; fin rays and lateral line rough with spinules; dorsal very long, of 50 to 60 rays. Icosteus, 444.

ACROTINÆ:

cc. Ventral fins wanting; caudal emarginate; lateral line without spinules; dorsal fin very long, of about 50 rays. ACROTUS, 445.

## 442. ICICHTHYS, Jordan & Gilbert.

*Icichthys*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1880, 305, (*lockingtoni*).

Body elongate, not elevated, not compressed at the bases of the vertical fins. Head moderate. Eyes lateral. Mouth terminal, little oblique, with small, sharp teeth in one series, in the jaws only. Premaxillaries not protractile. Gill membranes separate, free from the isthmus; gill rakers long. Pseudobranchiæ present; branchiostegals 7. Body covered with small cycloid scales. Lateral line continuous, unarmed. Bases of fins without spinules; dorsal and anal fins long and low, composed of soft rays only; pectoral fins moderate, their bases fleshy, as in *Icosteus*; ventral fins small, thoracic, I, 5. Caudal rounded. Pyloric cœca about 6, large. Bones all very flexible, cartilaginous. Deep-sea fishes. (ἐίκω, to yield or submit; ἰχθύς, fish; in allusion to the flexible skeleton.)

### 1369. ICICHTHYS LOCKINGTONI, Jordan & Gilbert.

Head 5; depth 4; eye large, lateral, longer than snout, 4 in head. D. 40; A. 28; scales 120. Body oblong, somewhat compressed, the caudal peduncle rather slender, Head moderate, compressed, with vertical cheeks, rather broad and slightly convex above, the snout abruptly descending. Mouth moderate, little oblique, the slender maxillary scarcely widened at the tip, extending to beyond front of pupil; anterior edge of premaxillary on level of lower rim of eye; lips thin; premaxillary tapering backward, not forming the whole margin of upper jaw; maxillary behind slipping entirely under the membranous edge of preorbital; preorbital rather wide with one or two series of rather large, thin, cycloid scales; lower jaw prominent, projecting in front, included at the sides. Teeth in jaws only, minute, sharp, closely and evenly set, larger and less numerous than in *Icosteus ænigmaticus*. Cheeks rather wide; preopercle with a prominent crest, behind which are some radiating mucous cavities; the bone with a broad, prolonged, flexible, membranaceous edge, covered with radiating striæ, each of which ends in a flexible point; opercle and subopercle rather large, extremely thin, and each crossed by radiating striæ. Branchiostegals 7. Gill rakers long, slender, sharp, close-set, and moderately stiff, their length nearly ¾ diameter of eye. Scales very small, soft, and smooth, covering the body evenly, but becoming smaller below; lateral line nearly straight, apparently continuous. Dorsal fin long and low, beginning nearly midway between vent and base of ventrals; all the rays soft and articulated, and all except the first branched; first rays very low, the fin gradually rising posteriorly, the highest rays 3 in head, somewhat scaly; anal fin similar, shorter, beginning slightly in front of the middle of the body and ending just in front of last rays of dorsal; caudal broad, fan-shaped, on a slender peduncle; the accessory rays numerous and procurrent; base of pectorals a little below the axis of body, their outline rounded; the fin short and small, shorter than head; ventrals short and small, thoracic, placed a little behind pectorals, with 1 obsolete spine and 5 soft rays, 1 of which is slightly filamentous, the fin 3 in head; fin rays not beset with spinules. Vent normal, immediately in front of the anal, without papilla. Air bladder wanting. Bones all soft and flexible. Skin not thick and tough, as in *Icosteus*, but thin and scaled. Color plain brown, paler below, somewhat punctulate. Length 7½ inches. Deep water off San Francisco, California; one specimen known. (Named for William N. Lockington, its discoverer, at that time ichthyologist of the California Academy of Sciences.)

*Icichthys lockingtoni*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., III, 1880, 305, deep water off San Francisco; (Coll. W. G. W. Harford); JORDAN & GILBERT. Synopsis, 621, 1883.

## 443. SCHEDOPHILUS, Cocco.

*Schedophilus*, COCCO, Giorn. Innom. Messina, Ann., III, 7, 57, 1834, (*medusophagus*).
*Crius*, VALENCIENNES, Ichth. Isles Canaries, 43, 1836–1844, (*bertheloti*).

Body ovoid, strongly compressed, covered with small, smooth scales, without prickles. Head small, the interorbital space broad. Eye small; snout obtuse; margin of preopercle with flexible spines. Mouth moderate, oblique, with one row of small teeth; none on the palate. Gill openings wide; gill rakers long, narrow, wide-set. One dorsal with a few flexible spines in front, beginning at the nape, its rays numerous; anal similar; caudal rounded, or slightly emarginate; base of vertical fins closely compressed; ventrals small, I, 5. Branchiostegals 7; pseudobranchiæ present. Skeleton extremely soft, as in *Icosteus*. Open seas, the young found at the surface. Several species recorded. (*σχεδία*, a raft; *φιλέω*, to love.)

### 1370. SCHEDOPHILUS MEDUSOPHAGUS, Cocco.

Head 4¼; depth 2⅔; eye 4. D. 40 to 50; A. 25 to 29. Body strongly compressed, elongate, ovoid in shape. Head small, as deep as long. Interorbital space convex, broader than diameter of eye, which is situated immediately below the upper profile of head, nearly as long as snout. Snout obtuse, with projecting lower jaw and oblique mouth; mouth of moderate width, the cleft extending to below front margin of eye; maxillary rather narrow, but widening toward its extremity. Teeth minute, implanted in a single series on the sharp edge of jaws; palate toothless. Preopercular margin armed with short spines, which usually become a little longer on posterior margin; these longer spines have an oblique dorsal direction; interoperculum spinous, the suboperculum less so; operculum membranous, its upper portion shows radiating osseous striæ, which project beyond the margin. Gill rakers of the outer branchial arch long, narrow, and rather widely set; gill openings very wide. Dorsal fin commencing above root of pectoral and terminating at a short distance from caudal, the caudal peduncle being about as deep as long; this fin rather low, the longest rays, behind the middle of fin, being not erectile into a vertical position; caudal fin (slightly injured) with a rounded margin, and rather shorter than the head; pectoral fin with a broad base, more than half as long as head, and with the upper rays longer than the lower; ventrals rather small, close together, inserted in advance of pectorals. The entire fish is covered with minute, cycloid scales; on the head they appear to be present on the cheek only; upper part of the head covered with a thick, spongy skin, as in *Centrolophus.* Color in life a pale greenish olive, marbled with darker, the markings being in the form of spots on the upper and in irregular longitudinal bands on the lower half of the body; vertical fins also spotted with blackish; iris nearly white, a ring of small white pores encircling the orbit. The specimen described is 9½ inches long and in good condition, with the exception of the lower part of the abdomen, which is lacerated and shrunk in consequence of the loss of the intestines. All parts of the body are in that state of softness which is peculiar to many deep-sea fishes. (Günther.) Pelagic, the young abundant in the mid-Atlantic, the adult taken in the Mediterranean, off Ireland and off Samoa. "This is primarily a pelagic surface form, but it seems very possible that it inhabits the middle or lower strata of the ocean as well. Dr. Günther says that it is evident that at least in the adult state, it descends to some depths. The want of firmness in the tissues seems to clearly indicate it as a deep-sea fish. He hazards the opinion that the depth to which it may descend probably does not exceed 100 fathoms. Calling attention to the fact that the young of the species are much more frequently found near the surface than the adult, he mentions the habit of this and similar forms of congregating around the floating *Medusæ*, and also questions the accuracy of the theory that fish ever feed upon *Medusæ*, since he says the fish could draw but little nourishment from these animals. As a matter of fact, many of our surface oceanic fishes feed voraciously upon various forms of *Medusæ* and upon *Salpa.* We have often taken large quantities of this kind of food from the stomachs of various surface *Scombroids*, as well as from *Alutera* and *Mola*. Dr. Günther's full description, which is quoted above, is taken from a specimen obtained at Port Rush, County Antrim, Ireland, in August, 1878, captured in a salmon net. Mr. Ogilby, who sent it to the British Museum, was very much impressed by the softness of the flesh. 'It was,' he says, 'the most delicate adult fish I ever handled; so much so, that within twenty-four hours after its capture the skin of the belly and the intestines fell off when it was lifted, and it felt in the hand quite soft and boneless.' This is quoted to emphasize what has been said regarding the softness of its tissues, and its similarity in this respect to the fishes inhabiting the abyss." (Goode & Bean.) (*Medusa*, jelly-fish; *φαγεῖν*, to eat.) (Eu.)

*Schedophilus medusophagus*, Cocco, Giorn. Innom. Messina, III, 7, 57, 1834, Messina; Günther, Cat., II, 412, 1860; Günther, Deep-Sea Fishes, Challenger, 46, 1887; Goode & Bean, Oceanic Ichth., 214, 1895.

*Crius bertheloti*, Valenciennes, Voy. Canaries, Poiss., 43, 1836–1844, Canaries.

### 444. ICOSTEUS, Lockington.

*Icosteus*, Lockington, Proc. U. S. Nat. Mus., III, 1880, 63, (*ænigmaticus*).
*Schedophilopsis*, Steindachner, Ichth. Beiträge, XI, 4, 1881, (*spinosus*).

Body oblong, much compressed throughout, the head thicker than any part of the body. Dorsal outline rising rapidly to the origin of the dorsal fin, thence more regularly curved; the region at the base of the dorsal and anal strongly compressed; caudal peduncle slender, widened at the base of the fin. Mouth large, horizontal; maxillary narrow, reaching to beyond middle of eye. Teeth in jaws in one row, slender, sharp, closely and regularly set, those in the lower jaw largest; no teeth on vomer, palatines, or pharyngeals. Gill rakers flexible, few; gill membranes separate, free from the isthmus. Branchiostegals 6; pseudobranchiæ well developed. Lateral line conspicuous, continuous, decurved, groups of small spines present along its entire length; no scales anywhere on body or fins. Fins rough, with small spinules; a series along each ray, dividing as the ray branches; dorsal fin commencing above the axil of the pectoral, composed of 50 to 60 rays, which are all soft and flexible, some of the anterior unbranched; the fin low in front, increasing in height behind; none of the rays more than once forked; anal shorter than dorsal, similar to it, of 35 to 40 rays; some of the anterior apparently undivided; caudal fin elongate, fan-shaped, the middle rays produced; accessory rays numerous, procurrent; pectorals with a fleshy base, fan-shaped, the middle rays longest; ventrals thoracic, inserted just behind the pectorals, narrow, consisting of 1 short subspinous ray and 4 long soft rays. Air bladder large. Vertebræ numerous, the vertebral column extremely flexible and soft. Cranial bones tolerably firm; bones of the face and opercles very flexible. Deep-sea fishes, from the Pacific. (*εἴκω*, to yield, submit; *ὀστέον*, bone—the "entire body being characterized by a want of firmness, as it can be doubled up as readily as a piece of soft, thick rag.")

#### 1371. ICOSTEUS ÆNIGMATICUS, Lockington.

Head 4; depth 3. D. 52 to 55; A. 37 to 40; V. I, 4; scales 110 to 120 (groups of spines). Longest ray of dorsal nearly reaching base of middle caudal rays. Eye 6 in head, scarcely half the length of the snout or the width of the interorbital space; diameter of caudal peduncle about 5½ in greatest depth. Pellucid yellowish or brownish, with purplish spots and blotches of irregular form; the spots largest above and most numerous along the lateral line; fleshy bases of caudal and pectorals spotted; throat and gill membranes with dark punctulations; fins dusky, obscurely blotched. Length about 12 inches. Pacific coast of United States; some 10 specimens known from deep water off California, Oregon, and Washington; the example before us from Monterey. (*αἰνιγματικός*, puzzling.)

*Icosteus ænigmaticus*, Lockington, Proc. U. S. Nat. Mus., III, 1880, 63, off San Francisco; (Coll. W. G. W. Harford); Jordan & Gilbert, Synopsis, 620, 1883.
*Schedophilopsis spinosus*, Steindachner, Ichth. Beitr., XI, 4, 1881, with figure, off San Francisco.
*Schedophilus enigmaticus*, Günther, Deep Sea Fishes, Challenger, 46, plate 44, 1887.

## 445. ACROTUS, Bean.

*Acrotus*, **Bean**, Proc. U. S. Nat. Mus., 1887, 631, (*willoughbyi*).

Shape of the body as in *Icosteus*, from which it differs in the absence of ventrals and spiny tubercles along lateral line, and in having an emarginate caudal. Head short; mouth moderate; eye small. Teeth minute, uniserial, on intermaxillary and mandible; vomer, palate, and pharynx toothless. Gill openings wide, the membrane not attached to isthmus; gills 4, a wide slit behind the fourth; gill rakers short, soft, and flexible; pseudobranchiæ well developed; branchiostegals 6. Vent somewhat in advance of middle of body. Caudal peduncle very slender; ventrals absent; caudal large, emarginate. Skin naked. Lateral line without tubercles. Vertebræ 70. Bones all soft and flexible. Size large. Probably worthy of family rank. (*ἀκροτος*, without oars (ventral fins).)

### 1372. ACROTUS WILLOUGHBYI, Bean.

Head 6; depth 3⅓; eye 12; snout 4; interorbital width 3. D. 41; A. 38; P. 20. Upper jaw 3 in head, maxilla reaches to below middle of eye. Caudal peduncle very slender; its least height little more than ⅓ its length and not much exceeding ¼ length of head. Gill rakers 15, 9 below the angle, longest about as long as eye. Origin of dorsal not clearly made out, the first ray that can be seen without dissection is nearly midway between eye and end of dorsal, but dissection reveals 7 rays in advance of this; dorsal beginning much nearer head in *Icosteus*, and dissection may show that rays are developed much farther in advance than we have been able to distinguish them; longest dorsal ray about 3 in head. Caudal peduncle as long as head without snout; caudal large, emarginate, its middle rays 4/7 as long as external rays and ⅔ as long as head; vent at a distance from tip of snout equal to 3 times, and from base of caudal a space equal to 3⅓ times length of head; the first evident anal ray at a distance behind the vent equal to ⅙ length of head; longest anal ray a little less than ⅓ as long as head; pectoral placed close to the head and nearly in the middle of the height, its length ⅔ length of head. Lateral line with a slight curve over the pectoral and becoming median about halfway between the pectoral and vent. Skin naked. Peritoneum very dark. Chocolate brown; inside of mouth and gill opening rich, dark brown. (Bean.) One specimen, 5¼ feet long, obtained at Damon, Washington (Quinault Agency) apparently thrown up in a storm from deep water. (Named for its discoverer, Charles Willoughby, Indian Agent at Quinault.)

*Acrotus willoughbyi*, **Bean**, Proc. U. S. Nat. Mus., 1887, 631, Quinault Agency, west coast of Washington; (Type, No. 39340. Coll. Chas. Willoughby); **Goode & Bean**, Oceanic Ichthyology, 217, 1895.

## Family CXXXVII. GRAMMICOLEPIDIDÆ.

Body compressed, covered with vertical linear scales. Mouth small, terminal; teeth minute, asperities on the jaws only. Lateral line sinuous, unarmed. Two dorsals, the first very short, triangular, the second and the anal long; anal fin preceded by two short, stout, separate spines. Vertebræ numerous, 10 + 36 = 46 in number. One genus, with a single species, found in deep waters in the West Indies. (*Grammicolepididæ,* Poey, Anal. Soc. Esp. Hist. Nat., II, 1873.)

## 446. GRAMMICOLEPIS, Poey.

*Grammicolepis,* POEY, Anal. Soc. Esp. Hist. Nat., II, 1873, (*brachiusculus*).

Body deep, compressed; eye large; mouth small; head and opercles partly rugose; teeth minute, none on the vomer or palatines. Pectoral short and rounded. Rays of dorsal, anal, and pectoral branched. A single species known. (*γραμμικός,* linear; *λεπίς,* scale.)

### 1373. GRAMMICOLEPIS BRACHIUSCULUS, Poey.

Head 5; depth nearly 2; D. VI, 34; A. II, 33; V. I, 6; P. 15; C. I, 13–1. Eye very large, 2½ in head. Body much compressed and quite deep. Branchial apertures deeply cleft, apparently only 4 branchiostegals. Snout short. Prefrontal turbinal and anterior suborbital extremely hard and covered with spiny rugosities. Preopercle and interopercle with rugose borders; remaining opercular bones entirely rugose. Mouth small, subvertically cleft; premaxillary process large and lodged in a fossa of the cranium; maxillary complicated; teeth simply a narrow row of minute prickles, none on vomer or palatines. First spine of dorsal rugose, as are the first ventrals, the two postanals, and the external ones of tail; rays of pectoral, second dorsal, and anal compressed, not branched at tip; pectorals very short and rounded; vertical fins all well developed; tail injured in the type; caudal peduncle large; ventrals thoracic, with a rugose spine and 6 flexible ones that are branched. Aside from the frontal bones and the suborbitals where the skin abruptly terminates and the nasal portion of snout, all the trunk and head is covered with scales, including the inferior mandible; scales very different from those found among related fishes, their length greatly exceeding their width; they have the appearance of parchment, transparent, brittle when dry, overlaping each other, and strengthened longitudinally by a raised lineal ridge; their contact with each other is so extremely intimate that it lends to the skin of either side a very smooth appearance although rough to the touch; the scales are so long that 4, 5, or 6 of them are sufficient to span the height of the trunk, one of such a series being crossed by the lateral line, where its presence is denoted by a raised ridge; leading scales on the body, above as well as below shorter, and where carried on to the head much more firm than those found on the fin rays; scales of the head, although shorter, of the same form as those of the trunk; no scales upon the fins. Caudal peduncle without cartilaginous or osseous plate at its sides; posterior to the anus, the ventral keel is rough. Cranium rather cartilaginous than osseous in structure, except the frontals, which are rugose in line in the supraorbital region, and bristly in front, as are the turbinals and suborbitals; these latter are 4 in number, the last 3 being very slender; 2 supratemporals; lower jaw with several rows of minute spines upon the dentary and articular elements. Vertebræ $10 + 36 = 46$. Anterior neural spine not excavated, being lofty and smooth; the 5 that follow are short and inclined backward; remaining ones slender, as also their hæmapophyses; last vertebræ without lateral spines. Pleurapophyses inconspicuous, feebly developed, of much the same size and shape as the epipleurals; but one pseudo-interneural spine in front of the one that supports the first dorsal fin ray. (Poey.) A single specimen of this remarkable fish was obtained by Poey at Cuba, in 1872. (Name a Latin diminutive of *βραχίον*, arm, from the small pectoral.)

*Grammicolepis brachiusculus*, Poey, Anal. Soc. Esp. Hist. Nat., II, 1873, Cuba; Shufeldt, Journal Morphology, II, 1888, 271, with 13 figures; Goode & Bean, Oceanic Ichth., 218, fig. 221, 1895.

In a natural arrangement the *Grammicolepididæ* should apparently be followed by the *Ephippidæ*, and these in turn by the *Chætodontidæ* and their allies, from which are derived the long series of aberrant or degenerate forms known as *Plectognathi*. The needs of a linear arrangement make it desirable to interrupt the series here to give place to the *Tetragonuridæ* and other aberrant forms which may be allied to the *Scombridæ*, and also to the long series of *Percoidea*, which are also very closely allied to the mackerel-like fishes. When the Percoid series is finished we shall revert to these remote branches from the Mackerel stem, if such the *Chætodontidæ* and the *Plectognaths* should prove to be.

## Family CXXXVIII. TETRAGONURIDÆ.

### (The Square Tails.)

Body long, slender, plump, not compressed, covered with hard, ciliated, grooved scales, which are very adherent. Lateral line single, straightish. Head scaly; opercles entire; eye large; mouth short, oblique, the jaws box-like, armed with one series of close set, comb-like teeth; teeth on palate. Dorsal divided, short and low; spines about 15; soft rays few; anal very small, its spines indistinct; caudal peduncle long, rather slender, with cartilaginous expansions at the base of caudal; caudal rather small, forked; ventrals small, subabdominal, placed below middle of pectoral, I, 5; pectorals short; no air bladder. Atlantic; probably but one species; in deep water, apparently rare. The relationships of the group are doubtful. Lowe places it among the mackerels, Günther near the *Mugilidæ*. It seems remotely allied to *Bramidæ* and other Scombroid forms, but it forms a distinct group without near relatives. (*Tetragonurina*, Günther, Cat., III, 407, 1861.)

### 447. TETRAGONURUS, Risso.

*Tetragonurus*, Risso, Ichth. Nice, 347, 1810, (*cuvieri*).
*Ctenodax*, Macleay, Proc. Linn Soc. N. S. Wales, 1885, 718, (*wilkinsoni*).

Characters of the genus included above. (*τετράγωνος*, square; *οὐρά*, tail; square-tailed, from the form of the caudal peduncle.)

### 1374. TETRAGONURUS CUVIERI, Risso.

(Escolar de Natura; Courpata; Square Tail; Sea-Raven.)

Head 4⅓; depth 7; eye about 3½. D. XV–11; A. II, 9; V. I, 5; scales 90. Body fusiform, not compressed, plump and compact, the tail becoming distinctly four-angled; at base of caudal these four equidistant angles rise suddenly into four short, elevated, lacerato-serrate crests or ridges of produced toothed scales, these serrate keels meeting in the fork of the fin, the keels as long as eye. Belly underneath round, with a fine, closed groove from ventral fins to vent; a similar groove behind anal. Head broad above; eye very large; snout short, truncate, as long as eye; jaws equal; maxillary slipping below preorbital; gape moderate, reaching front of eye; lower jaw with very high gums, shutting within upper jaw like a trunk within its lid; teeth bony, white, and glassy, in one row in each jaw, arranged like comb teeth; lower teeth larger, about 40 in each side of each jaw, the teeth of lower jaw larger backward; upper teeth subconic, lower compressed, lancet-like; vomer and palatines with small teeth; gill openings very large, the membranes connected below, free from isthmus; pectorals short, rather low; ventrals small, ovate, rather behind pectorals, fitting into a hollow of the belly. Dorsal inserted behind ventrals, of 15 low pungent spines depressible in a groove; soft dorsal short, scaleless, not in a groove; anal similar, shorter, its first two rays small and simple; caudal broad, rather short, well forked, its rays feeble, much articulate. Whole body covered with a hard and compact armor of close-set scales in 83 regular oblique spiral rings, those on tail smaller. These scales are so firmly fixed that they can be torn off in spiral belts. Their edges are striate and finely ciliate, the striæ being also rough. Lateral line nearly straight; head mostly scaly; the surface everywhere rough. Color uniform rusty black, the edges of the scales hyaline; inside of mouth blackish. Length 1 foot. Œsophagus with soft papillæ; stomach a long conic sac; cœca numerous, unequal; vertebræ 36 + 22 = 58. (Lowe.) Open Atlantic, once taken off our Atlantic Coast. Originally described from Nice. Risso says that it lives at great depths, approaching the coast only in August at the time of spawning, and that its natation is slow and feeble. It has since been found off Toulon and Marseilles, and by Lowe near Madeira, where it was taken swimming at the surface. Lowe is also of the opinion that it occurs at very great depths. Its flesh is white and tender, but at times when eaten it is a violent poison, as was demonstrated by the personal experience of Risso himself. This Risso thinks may be due to the poisonous jelly fishes on which it feeds. A single specimen was obtained by the United States Fish Commission at Woods Hole, November 10, 1890 (No. 44436, U. S. Nat. Mus.). (Goode & Bean.) (Named for Georges Chrétien Leopold Dagobert Cuvier, 1769–1832, the great comparative anatomist, who laid the foundations of modern ichthyology.) (Eu.)

*Tetragonurus cuvieri*, Risso, Ichth. Nice, 347, 1810, **Nice**; Günther, Cat., iii, 408, 1861; Goode & Bean, Oceanic Ichth., 230, fig. 417, 1895.

*Tetragonurus atlanticus*, Lowe, Fishes Madeira, 129, pl. xix, 1843, **Madeira.**

## Family CXXXIX. PEMPHERIDÆ.

### (The Deep-water Catalufas.)

Body oblong, compressed, covered with moderate or small scales, which are distinctly ctenoid, the vent well forward, the long base of the anal very oblique. Lateral line nearly straight, unarmed, extending on the caudal fin; membranes of anal more or less scaly, that of dorsal mostly naked. Head compressed, with blunt snout, narrow preorbital, and large eye; bones of head unarmed, or very nearly so; nostrils double; cheeks, opercles, and jaws scaly; mouth large, very oblique; premaxillary protractile; maxillary very broad posteriorly. Small teeth on jaws, vomer, and palatines. Gills 4; gill membranes separate, free from the isthmus. Branchiostegals 7. Dorsal fin very short, median or anterior, with 5 or 6 slender graduated spines, continuous with the soft rays, the first of which is longest; no projecting interspinal bones before dorsal. Anal fin very long, not falcate, with 2 or 3 small spines in front; caudal lunate or moderately forked, on a stoutish peduncle. Ventrals moderate, I, 5, inserted below the pectorals, which are rather long. Supraoccipital crest high, slender; vertebræ in normal number, 10 + 24 (*Pempheris*); the abdominal vertebræ short; the caudal vertebræ gradually lengthened. Coracoids much dilated. Air bladder large, thick, divided into two by a constriction, the anterior part smaller and round. Pyloric cœca 6 or 7, some of them longer than the stomach. Small fishes, inhabiting rather deep water in the tropics. Three genera, *Pempheris*, *Parapriacanthus* (*Pempherichthys*), and *Neopempheris*, with about 12 known species. The relationships of the family are not very clear. In the form and proportions of the fins *Pempheris* resembles *Kurtus*, with which genus it has been usually associated. *Kurtus* has feeble scales, nearly or quite naked head and free spines, and antrorse interspinals before the dorsal fin. *Kurtus* seems to be a member of the Scombroid group. *Pempheris* shows but few Scombroid characters, and bears a superficial resemblance to *Priacanthus*. We allow the supposed relation to *Kurtus* to remain, and place the group at the end of the *Scombroidei*, where in fact it probably belongs. (*Carangidæ*, part, Günther, Cat., II, 509, 510, 1860.)

*a.* Anal fin very long, its first ray in advance of middle of body. PEMPHERIS, 448.

## 448. PEMPHERIS, Cuvier & Valenciennes.

*Pempheris*, Cuvier & Valenciennes, Hist. Nat. Poiss., VII, 296, 1831, (*onalensis*).

Body short and deep, tapering posteriorly, covered with rather small scales, 35 to 70 in lateral line. Vent in advance of middle of length. Dorsal rays VI, 9; anal rays III, 35 to 46. Caudal lunate. (*Pempheris*, a name given by Numenius to some little fish, now unrecognized. "Ces noms sans caractère indicatif de leurs espèces se trouvant ainsi vacantes les naturalistes s'en emparent comme de choses sans maîtres pour les appliquer aux genres nouveaux qu' ils decouvrent." (Valenciennes.)

*a.* Anal rays III, 32 to III, 25.

*b.* Scales in lateral line nearly 50; 32 in a lengthwise series; eye 2¼ in head. MEXICANUS, 1375.

*bb.* Scales in lateral line 56; eye 3½ in head. SCHOMBURGKI, 1376.
*aa.* Anal rays III, 31. Scales in lateral line 58; eye very large, 2⅓ in head. MULLERI, 1377.
*aaa.* Anal rays III, 24. Scales in lateral line 56; eye 2½ in head. POEYI, 1378.

### 1375. PEMPHERIS MEXICANUS,* Cuvier & Valenciennes.

D. VI, 9; A. III, 35; scales in a lengthwise series 32, 16 scales in a transverse series. Profile a little concave. Copper color; the fins yellow, without black markings. Pacific coast of Mexico, only the type known, from Acapulco. (Cuvier & Valenciennes.)

*Pempheris mexicanus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., VII, 308, 1831, Acapulco.

### 1376. PEMPHERIS SCHOMBURGKI, Müller & Troschel.

Head 4; depth 3. D. VI, 9; A. III, 33; V. I, 5; scales in lateral line 56, besides about 13 on the caudal fin. Profile depressed above the eye; lower outline strongly convex anteriorly, then straight along the belly, then contracted so that the base of last anal ray is on level of middle of pupil. Scales rather large, distinctly ctenoid, deciduous, except those along the lateral line, which are smaller than the others and persistent. Eye 3½ in head; half broader than interorbital space. Maxillary reaching beyond middle of eye; each jaw with two rows of small, slender teeth directed backward; small teeth in narrow bands on vomer and palatines; preopercle finely serrate; fin rays slender; height of dorsal greater than its base, which is about half length of head; anal base not quite 2½ in body, its first rays 3½ in head; anal spines slender, graduated; caudal moderately lunate, the upper lobe the longer; pectorals falcate, as long as head; ventral short, as long as eye; lateral line curved to below middle of dorsal and extending on the scales of caudal fin. Violet above, golden yellow below (in spirits); scaly sheath of anal with dark specks. (Steindachner.) Barbados and Cuba. (Named for Robert H. Schomburgk, author of the History of Barbados.)

*Pempheris schomburgki*, MÜLLER & TROSCHEL, in Schomburgk's History of Barbados, 669, 1845, Barbados; D. V, 9; A. III, 35; STEINDACHNER, Ich. Notizen, I, 8.

### 1377. PEMPHERIS MULLERI, Poey.

(CATALUFA DE LO ALTO.)

Head 3⅖; depth 2⅖; eye 2⅓ in head; base of anal 2¼ in body or 1⅔ times as long as head. D. IV, 10; A. III, 31; scales 56 to 60. Color red, silvery below, dusky on back and base of anal. Length about 5 inches. West Indies to Brazil; rather rare on the coast of Cuba, in waters of moderate depth. A handsome little fish, resembling a young *Priacanthus*. Probably identical with *Pempheris schomburgki.* (Named for the noted comparative anatomist, Prof. Johannes Müller, who wrote on the fishes of Barbados.)

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* The following account of the original type of *Pempheris mexicana* has been sent us by our friend, Mr. Alexander Thominot: "Body compressed, its height 2½ times in the total length; head a little more than four times in this dimension; snout 6 in head; eye as long as caudal peduncle; insertion of dorsal nearer tip of snout than root of caudal; pectorals as long as head. Total length 0.140 mm.; head 0.033 mm.; snout 0.005 mm.; eye 0.015 mm.; caudal length 0.028; length of pectorals 0.033; base of dorsal 0.018; height of dorsal 0.026. Fin rays D. 13; P. 16; V. I, 5; A. 32; C. II-I-II. Scales in lateral line nearly 50."

*Pempheris mülleri*, Poey, Memorias, II, 203, 1860, Cuba; (the later *Pempheris mulleri* of Klunzinger is a different species).

*Pempheris schomburgki*, Jordan, Proc. U. S. Nat. Mus., 1886, 38, and 1890, 317; perhaps not of Müller & Troschel.

### 1378. PEMPHERIS POEYI, Bean.

Head 3; depth 2½; eye 2½; snout 2 in eye. D. IV, 8; A. III, 24; scales 2–56–12. Maxillary about ½ as long as head, its posterior extremity very much widened; mandible slightly longer than maxilla, its length nearly ½ greatest height of body; width of interorbital space equal to ½ length of maxillary; origin of dorsal slightly behind vertical through origin of ventral; distance from tip of snout to origin of dorsal not much more than length of anal base; longest dorsal ray slightly exceeding ½ length of head; origin of dorsal fin considerably in advance of middle of total length; origin of anal directly under end of dorsal; length of anal base equal to greatest height of body and not much in excess of length of head; origin of ventral almost directly under that of dorsal; third ray of ventral as long as eye; pectoral 4 in body; caudal imperfect in type. Cuba. Only the type known. (Bean.) Named for Prof. Felipe Poey, who collected the type of the species.)

*Pempheris poeyi*, Bean, Proc. U. S. Nat. Mus., 1885, 229, Havana. (Type, No. 37184. Coll. Poey.)

## Group PERCOIDEA.*

### (The Perch-like Fishes.)

A group of fishes of diverse habits and forms, but on the whole, representing better than any other the typical *Acanthopterygian* fish. The group is incapable of concise definition, or, in general, of any definition at all; still, most of its members are definitely related to each other, and bear in one way or another a resemblance to the typical form, the perch, or more strictly to its marine relatives, the sea bass or *Serranidæ*. The following analysis gives most of the common characters of the group:

Body usually oblong, covered with scales, which are typically ctenoid, not smooth nor spinous, and of moderate size. Lateral line typically present and concurrent with the back. Head usually compressed laterally, and with the cheeks and opercles scaly. Mouth various, usually terminal and with lateral cleft, the teeth various, but typically pointed, arranged in bands on the jaws, vomer, and palatine bones; gill rakers usually sharp, stoutish, armed with teeth; lower pharyngeals almost always separate, usually armed with cardiform teeth; third upper pharyngeal moderately enlarged, elongate, not articulated to the cranium, the fourth typically present; gills 4, a slit behind the fourth; gill membranes free from the isthmus, and usually not connected with each other; pseudobranchiæ typically well developed. Branchiostegals few, usually 6 or 7. No bony stay connecting the suborbital chain to the preopercle. Opercular bones all well developed, normal in position; the preopercle typically serrate. No cranial spines. Dorsal fin variously developed, but always with some spines in front, these typically stiff and pungent; anal fin typically short, usually with 3 spines, sometimes with a larger number, sometimes with none; caudal fin various, usually lunate; pectoral fins well developed, inserted high; ventral fins always present, thoracic, separate, almost always with 1 spine and 5 rays. Air bladder usually present, without air duct in the adult; simple and generally adherent to the walls of the abdomen. Stomach cœcal, with pyloric appendages, the intestines short in most species, long in the herbivorous forms. Vertebral column well developed, none of the vertebræ especially modified, the number 10 + 14, except in certain extra-tropical and fresh-water forms, which retain the primitive higher numbers. Shoulder girdle normally developed, the post-temporal bifurcate, attached to the skull, but not coossified with it; none of the epipleural bones attached to the center of the vertebræ; coracoids normal, the hypercoracoid always with a median foramen, the basal bones of the pectoral (actinosts or pterygials) normally developed, 3 or 4 in number, hourglass-shaped, longer than broad; premaxillary forming the border of the mouth, usually protractile; bones of the mandible distinct. Species very numerous, found in all seas except those of the Arctic regions. Many species inhabit fresh waters, especially in North America and Europe. These fresh-water forms are apparently nearer the primitive stock than the marine species are. The *Elassomidæ*, *Centrarchidæ*, and *Percidæ* are the most primitive, and apparently form, with the *Percopsidæ* and *Aphredoderidæ*, an almost continuous series. This series we are compelled to break in a linear arrangement for the purpose of bringing in other series of transitional forms, which culminate in the *Berycoids* and the *Scombroids*.

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* As these sheets are passing through the press we have received, through the courtesy of our friend, Dr. G. A. Boulenger, of the British Museum, proof sheets of the first volume of his "Catalogue of the Perciform Fishes in the British Museum." This gives promise of being, like its prototype, Dr. Günther's "Catalogue of the Fishes of the British Museum," a monumental work indispensable to all students of fishes. We have made free reference to Dr. Boulenger's conclusions in those genera of *Perciformes* or *Percoidea*, in which his work is printed in advance of ours.

*a.* Maxillary not sheathed by the preorbital, or only partially covered by the edge of the latter; ventral with its accessory scale very small or wanting; pectoral without accessory scale; sheath at base of spinous dorsal little developed; vomer usually with teeth; opercle usually ending in a spine.
  *b.* Precaudal* vertebræ with transverse processes from the third or fourth to the last; ribs all but the last 1 to 4, sessile, inserted on the centra behind the transverse processes; anal spines 3 or more.
    *c.* Pseudobranchiæ rudimentary, covered by the skin.
      *d.* Lateral line wholly wanting; dorsal spines 4 or 5; vertebræ about 10 + 14 = 24. ELASSOMIDÆ, CXL.
      *dd.* Lateral line more or less developed; dorsal spines 6 to 15; vertebræ 29 to 33. CENTRARCHIDÆ, CXLI.
    *cc.* Pseudobranchiæ large; dorsal spines about 10; vertebræ 10 + 15 = 25. KUHLIIDÆ, CXLII.
  *bb.* Precaudal anteriorly without transverse processes; all or most of the ribs inserted on the transverse processes when these are developed.

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* These characters are taken from Boulenger, Cat., I, p. 2.

*e.* Anal spines 2 or 1, very rarely obsolete; vertebræ in increased number (30 to 46). PERCIDÆ, CXLIII.

*ee.* Anal spines 2 (rarely 3); vertebræ 24 or 25; pseudobranchiæ well developed; dorsal fin divided. CHEILODIPTERIDÆ, CXLIV.

*eee.* Anal spines 3 or none, never 2 nor 1; pseudobranchiæ well developed; dorsal fin continuous or divided; vertebræ 24 to 35.

*f.* Vomer, and usually palatines also, with teeth.

*g.* Lateral line strongly marked, extending to end of caudal fin; body elongate; teeth small. CENTROPOMIDÆ, CXLV.

*gg.* Lateral line not extending on caudal fin.

*h.* Anal fin shorter than dorsal; head not everywhere covered with rough scales; postocular part of head not shortened. SERRANIDÆ, CXLVI.

*hh.* Anal fin scarcely shorter than dorsal and similar to it; head and body everywhere covered with rough scales; body deep, compressed. PRIACANTHIDÆ, CXLVIII.

*ff.* Vomer without teeth; dorsal fin continuous; body deep, compressed. LOBOTIDÆ, CXLVII.

*aa.* Maxillary slipping for most of its length under the edge of the preorbital, which forms a more or less distinct sheath; ventrals with an accessory scale; opercle without spines; maxillary without supplemental bone; anal spines 3, rarely 2.

*i.* Carnivorous species; intestines of moderate length; teeth in jaws not all incisor-like; vertebræ usually 24 or 25.

*j.* Spines of premaxillary not greatly produced, not extending backward to the occiput; mouth moderately protractile.

*k.* Vomer with teeth.

*l.* Teeth in jaws usually unequal, some of them more or less canine-like; no distinct tubercles from the cranium for the articulation of the epipharyngeals; enlarged apophyses for the articulation of the palatines and preorbital; first 4 vertebræ without parapophyses; maxillary long. LUTIANIDÆ, CXLIX.

*kk.* Vomer without teeth; palatines and tongue toothless.

*m.* Teeth on sides of jaws not molar; maxillaries formed essentially as in the *Serranidæ.* HÆMULIDÆ, CL.

*mm.* Teeth on sides of jaws molar; maxillaries peculiar in form and in articulation, unlike those of the *Serranidæ.* Anterior teeth conical, or else more or less incisor-like; preopercle entire. SPARIDÆ, CLI.

*jj.* Spines of premaxillary extending backward to the occiput, so that the mouth is excessively protractile; preorbital very narrow.

*n.* Lower pharyngeals well separated; teeth in jaws small or wanting; vomer with minute teeth or none; dorsal fin continuous or deeply notched; preopercle entire. MÆNIDÆ, CLII.

*nn.* Lower pharyngeals closely approximated, often apparently united; teeth present, small; dorsal fin notched. GERRIDÆ, CLIII.

*ii.* Herbivorous species; intestinal canal elongate; anterior teeth in jaws incisor-like; no molars or canines; premaxillaries moderately protractile. KYPHOSIDÆ, CLIV.

## Family CXL. ELASSOMIDÆ.

### (PIGMY SUNFISHES.)

Body oblong, compressed, covered with rather large cycloid scales. Mouth small, terminal, the lower jaw projecting; each jaw with rather strong conic teeth, in few series, directed forward vomer with a few weak teeth; palatines toothless; upper jaw very protractile. Bones of head with entire edges. Cheeks and opercles scaly. Gill membranes broadly united, free from isthmus; gill rakers tubercle-like. Lower pharyngeals narrow, separate, with sharp teeth. Branchiostegals apparently 5. Lateral line obsolete. Vent normal. Dorsal fin single, small, with 4 or 5 spines; anal with 3 spines; ventrals thoracic, I, 5; caudal rounded. Pseudobranchiæ small, glandular, covered by the skin. No pyloric cœca. Posterior processes of premaxillaries extending to the frontals, the latter smooth; parietal and supraoccipital crests not produced on the frontals. Vertebræ 10 + 14 or 15 = 24 or 25. Two species known; very singular little fishes, among the very smallest known, inhabiting the swamps of the southern United States, intermediate between the *Aphredoderidæ* and *Centrarchidæ*. Like *Percopsis*, *Umbra*, *Aphredoderus*, *Dallia*, *Chologaster*, etc., the *Elassomidæ* constitute a relic of a very ancient fauna. Dr. Boulenger places *Elassoma* among the *Centrarchidæ*, an arrangement to which we see no serious objection. *Elassoma*, as Dr. Boulenger suggests, is a dwarfed sunfish, bearing much the same relation to the others that the darters bear to the perch. (*Elassomidæ*, Jordan & Gilbert, Synopsis, 461, 1883.)

## 449. ELASSOMA, Jordan.

*Elassoma*, JORDAN, Bull. U. S. Nat. Mus., x, 50, 1877, (*zonata*).

Characters of the genus included above. (*ἐλάσσωμα*, a diminution.)

*a.* Scales moderate, 38 to 45 in a longitudinal series. ZONATUM, 1379.

*aa.* Scales very large, 27 to 30 in longitudinal series. EVERGLADEI, 1380.

### 1379. ELASSOMA ZONATUM, Jordan.

Head 3; depth 3½; eye large, 3 in head. D. IV, 10, or V, 9; A. III, 5; B. 5; scales 38 to 42–19. Body oblong, compressed, the nape rather broad and depressed; head narrowed forward. Mouth small, oblique, the maxillary scarcely reaching pupil. Teeth in jaws stout, conical, slightly curved, directed forward in 2 or 3 rows. Color olive green, everywhere finely punctulate; sides with about 11 parallel vertical bands of dark olive, about equal in width, narrower than the eye, about as wide as the pale interspaces; a conspicuous roundish black spot, nearly as large as the eye, on the sides just above the axis of the body, under the beginning of the dorsal; soft fins faintly barred; a blackish bar at base of caudal. Length 1½ inches. One of the smallest of our spinous-rayed fishes, inhabiting sluggish streams and bayous from Southern Illinois to Texas, Louisiana, and Alabama; not very common and only in still waters of small extent. Variable. (*zonatus*, banded.)

*Elassoma zonata*, JORDAN, Bull. U. S. Nat. Mus., x, 50, 1877, Little Red River, Judsonia, White County, Arkansas. (Coll. Prof. Henry S. Reynolds).

*Elassoma zonatum*, JORDAN & GILBERT, Synopsis 461, 1883; BOULENGER, Catalogue of Fishes in the British Museum, I, 34, 1895.

### 1380. ELASSOMA EVERGLADEI, Jordan.

Head $3\frac{1}{10}$; depth 3½; eye 3 in head. D. IV, 9 (III, 8 to IV, 9); A. III, 5, (to III, 7); scales 28–13 or 14. Body more elongate and less compressed than in *Elassoma zonatum*; the head thick, moderately pointed anteriorly, flattish, and moderately wide above. Mouth oblique, very small, its outline curved, upper jaw very protractile, lower jaw projecting; snout very short, not longer than pupil; preorbital very narrow. Maxillary of moderate width, barely reaching the vertical from front of eye, its length 4 in head. Teeth in narrow bands, those of the outer series enlarged, close-set, slender, and curved. Apparently a few teeth on the vomer. Cheeks and opercles scaly, the former with 3 or 4 rows of scales. Preopercle entire; opercle unarmed, emarginate behind. Gill membranes broadly connected across the isthmus. Breast with small scales; scales of body very large, cycloid; no trace of lateral line. Gill rakers very small, tubercular. Pseudobranchiæ very small, apparently covered by skin, as in the *Centrarchidæ*. Vent normal in position. Dorsal fin low, the first spine short, the others graduated; ventral fins very slender and narrow, their filamentous tips nearly reaching front of anal; their rays I, 5; the inner ray short, so that the number appears on a hasty examination to be I, 4; pectoral 1⅘ in length of head; caudal slightly emarginate, 1½ in head. Color, in spirits, dusky olive, without cross bands or scapular spot; centers of scales paler, thus forming faint longitudinal streaks; many scales of back and sides each with a dark brown spot; these irregularly scattered; body and head soiled with dark points; dorsal, anal, and caudal conspicuously marked with cross bands formed of dark dots; ventrals and anal largely dusky, similarly but more faintly barred. Length 1⅓ inches. Swamps of southern Georgia and Florida, locally common in dark waters tributary to the Everglades. Extremely variable in coloration and in number of fin rays, if all the known specimens really belong to one species.

*Elassoma evergladei*, JORDAN, Proc. U. S. Nat. Mus., 1884, 323, Indian River and Lake Jessup, Florida; (Type, No. 25326(8). Coll. R. Edward Earll); GILBERT,* Bull. U. S. Fish Comm., VIII, 1888, 228; WOOLMAN,† Bull. U. S. Fish Comm., x, 1890 (1892), 299 and 300, pl. 53, fig.

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* "A single specimen from the Satilla River at Waycross, answering well the original description, but with the anal III, 7, instead of III, 5; D. IV, 9; scales 27. Fins all high, the ventrals reaching slightly beyond origin of anal, the longest dorsal ray 1⅓ in head. In spirits, faint traces of 6 or 7 dusky cross bars; a white area on base of caudal. In life, a blue band under eye and a number on sides. Dorsal spines with blue."—*Gilbert.*

† Woolman gives the following account of specimens of this species from Hillsboro River, Florida: "Two very fine specimens were taken in Pemberton Creek, which differ in several particulars from the types of this species (*Elassoma evergladei*). Total length of specimens 25 and 27 mm. respectively; length to caudal fin 22½, 23 mm.; greatest height of body 6, 7 mm.; depth of caudal peduncle 3, 3 mm; length of head 6, 7 mm.; interorbital area 2, 2 mm.; eye, 2, 2 mm.; distance from tip of snout to front of dorsal, 10, 10 mm. Number of dorsal spines and rays, III, 8; III, 8; length of base of dorsal 7, 7 mm.; longest dorsal spine 3, 3, mm.; longest dorsal ray 5, 5; anal IV, 5; IV, 5; ventrals reaching anal; scales 28, 28. Ground color, very dark brown, nearly black, with 3 cross bars behind dorsal, between which there is a dark metallic blue space; spot on opercle of a dull carmine color; 2 small spots of the same color at base of caudal; spots of blue on other parts of body, notably along lateral line; fins dark; upper half of dorsal black; 2 lighter spots on the last rays of dorsal.

"Several specimens were obtained in Mill Creek which correspond more closely with the originals of *Elassoma*. The measurements of 3 of these are as follows: Length 25, 25, 23 mm. respectively; length to base of caudal 21, 21, 19 mm.; greatest depth 6, 7, 5 mm.; depth of caudal peduncle 3, 3, 3 mm.; length of head 6, 6, 6 mm.; eye 1½, 1½, 1½ mm.; distance from end of snout to origin of dorsal 9, 9½, 8 mm. Dorsal rays IV, 8; IV, 9; IV, 9; anal rays III, 5; III, 5; III, 5; number of scales 27, 28, 27. Ground color dark brown, thickly covered with darker spots having no definite arrangement; a few deep lustrous blue scales on body; dorsal dark, showing in some specimens a double row of dark-red spots, forming 2 stripes parallel with edge of fin. There seems to be some variation in size of eye and width of interorbital space." (Woolman, *l. c.*)

4; LÖNNBERG,* Øfvers. Kong. Vetensk. Akad. Förh., 123, 1894; Boulenger, Cat., I, 34.

## Family CXLI. CENTRARCHIDÆ.†

### (THE SUNFISHES.)

Body more or less shortened and compressed; the regions above and below the axis of the body nearly equally developed, and corresponding to each other, and the pseudobranchiæ imperfect. Head compressed. Mouth terminal, large or small. Teeth in villiform bands, the outer slightly enlarged, without canines; teeth present on premaxillaries, lower jaw, and vomer, and usually on palatines, also sometimes on tongue,

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* Dr. Einar Lönnberg gives the following account of the specimens observed by him about Orlando, Florida, and provisionally named "*Elassoma orlandicum*":

"Localities—Fern Creek and small lakes around Orlando, Orange County; Tohopekaliga and other waters around Kissimmee, Osceola County; Arcadia, De Soto County.

"This little fish seems to be extremely variable. When I obtained my first specimens in Fern Creek I surely believed that I had found a new species. I was led to that opinion by the number of spines and soft rays in the vertical fins. Jordan (Proc. U. S. Nat. Mus., 1884) describes *Elassoma evergladei* with 4 spines and 9 or 10 soft rays in the dorsal and 3 spines and 5 soft rays in the anal. On my specimens I counted 5 spines (in one only 4) and 11 or 12 soft rays, and the formula of the anal was III, 7. There was thus 1 spine and 1 or 2 soft rays in the dorsal and 2 soft rays in the anal more than in the typical *E. evergladei.* I therefore believed it just to establish a new subspecies with the name *orlandicum*, the more as also the color, etc., was different. Later on I found in the literature that Woolman (*l. c.*, p. 299) had found in Pemberton Creek variations in another direction, that is with the formula III, 8 for the dorsal, and IV, 5 for the anal. But in the Santa Fé River the specimens were more similar to mine with dorsal IV, 9–12; anal III, 5–7. Through this the variability of *E. evergladei* becomes still more evident. The fins are larger in the males, as the following measurements will show:

| | Male. | Female. |
|---|---|---|
| | *Millimeters.* | *Millimeters.* |
| Length without caudal | 20½ | 20 |
| Length of head | 6½ | 6 |
| Depth of body | 6½ | 6 |
| Vertical height of dorsal | 2⅓ | 2 |
| Vertical height of anal | 3½ | 2⅓ |
| Length of dorsal | 10 | 8 |
| Length of caudal | 5 | 4⅓ |
| Height of caudal | 8 | 5 |

"My largest specimen measured 25 millimeters without the caudal, which is rounded, not slightly emarginate. Woolman's figure (*l. c.*, Pl. LIII) has the caudal rounded, too. In the females the ventrals reach to the anal; in the males the filament from the fourth ray surpasses the spines of anal. Intestinal canal short, no appendices pyloricæ. Eggs large, but few in number. December and January seem to be the spawning season of this little fish, and in that time the male has such a bright color that it must be regarded as one of the handsomest freshwater fishes. It is black, with 7 more or less complete vertical cross bars of bright metallic blue. A semicircular blue spot below and behind eye. At the base of the caudal there are 2 whitish blue or blue spots surrounded by black. The ventral fins almost blue with black border. At the base the dorsal has 2½ bands of blue spots; the anal has 1 or 2 bands of the same kind. A little within the black margin of all the vertical fins, the chief color of which is black, is a broad, blue band, which is broadest and brightest on the anal; pectorals not colored. After the spawning time the blue will change to paler greenish blue but still metallic. In spirits the blue color is lost and the fishes become blackish with paler band where the blue has been. Both the caudal spots are always conspicuous. The female is not so bright. Its color is a kind of rusty brownish with darker spots. These are sometimes arranged in three ranges along the side. The belly is always paler and the entrails shine through, the liver reddish and the intestines dark, if they contain anything. At the base of the caudal two whitish, dark-bordered spots. Dark spots on the rays make one band on the anal, two on the dorsal, and three on the caudal."

† For a useful review of the species of this family see Bollman in Report U. S. Fish Comm., XVI, 1888 (1892), 557–579, plates LXVIII–LXXII.

pterygoids, and hyoid. Premaxillaries protractile; maxillary with a supplemental bone in the large-mouthed forms, sometimes minute or obsolete in others. Preopercle entire or somewhat serrate; opercle ending in two flat points or prolonged in a black flap at the angle. Preorbital short and deep; first suborbital narrow, the maxillary not slipping under its edge. Nostrils 2, on each side. Gills 4, a slit behind the fourth. Pseudobranchiæ small, almost glandular, nearly or quite covered by skin. Gill membranes separate, free from the isthmus. Branchiostegals 6, rarely 7. Gill rakers variously formed, armed with small teeth; lower pharyngeal bones separate, their teeth conic or sometimes paved. Cheeks and opercles scaly; body fully scaled, the scales usually not strongly ctenoid, rarely cycloid; lateral line present, usually complete. Dorsal fins confluent, the spines 6 to 13 in number (usually 10), depressible in a shallow groove; anal spines 3 to 9. Intestinal canal short. Pyloric cœca 5 to 10. Vertebræ 28 to 35 (13 to 18 + 15 to 17), Entopterygoid present. Precaudal or abdominal vertebræ with transverse processes from the third or fourth to the last; ribs all but the last 2 to 4 sessile, inserted on the centrum behind the transverse proceses. Frontals with a pair of large muciferous channels which converge posteriorly or are confluent with a transverse channel connecting the postfrontals, their posterior openings close together on the median line in front of the supraoccipital crest. Coloration usually brilliant, chiefly greenish. Sexes similar; changes with age often great. Fresh-water fishes of North America; genera 12; species about 30, forming one of the most characteristic features of our fish fauna. Most of the species build nests, which they defend with much courage. All are carnivorous, voracious, and gamy. All are valued as food, their importance being in direct proportion to the size which they attain. The group has been divided by Dr. Gill into three subfamilies very closely related to each other—*Centrarchinæ*, *Lepominæ*, and *Micropterinæ*. Most of the species belong to the *Lepominæ*. The *Micropterinæ* approach most nearly to the *Serranidæ*. At the same time they are perhaps farthest from the primitive stock from which the group has sprung. (*Percidæ*, group *Grystina*, Günther, Cat., I, 256–261, 1859.)

CENTRARCHINÆ:

- *a.* Dorsal fin scarcely longer than anal.
    - *b.* Dorsal spines 5 to 8; anal spines 6; spinous dorsal shorter than soft dorsal; body elongate, compressed. POMOXIS, 450.
    - *bb.* Dorsal spines 11 or 12; anal spines 7 or 8; spinous dorsal longer than soft dorsal; body short and deep, compressed. CENTRARCHUS, 451.
- *aa.* Dorsal fin much larger than the anal; gill rakers rather short.

  LEPOMINÆ:

    - *c.* Body comparatively short and deep, the depth usually more than ⅖ the length; dorsal fin not deeply emarginate.
        - *d.* Tongue and pterygoids with teeth; mouth large, maxillary reaching past middle of eye.
            - *e.* Scales cycloid; caudal convex. ACANTHARCHUS, 452.
            - *ee.* Scales ctenoid; caudal concave behind.
                - *f.* Opercle emarginate behind; anal spines 5 to 8.
                    - *g.* Lingual teeth in a single patch; gill rakers about 10; preopercle serrate only at its angle, other membrane bones entire; lower point of opercle without pointed striæ. AMBLOPLITES, 453.

*gg.* Lingual teeth in two patches; gill rakers about 20; most of the membrane bones of the head serrate; lower point of opercle striate, the striæ ending in sharp points. ARCHOPLITES, 454.

*ff.* Opercle ending in a black convex process or flap; anal spines 3; preopercle entire. CHÆNOBRYTTUS, 455.

*dd.* Tongue and pterygoids toothless; mouth small, the maxillary barely reaching past middle of eye.

*h.* Caudal convex; opercle emarginate, without flap.

*i.* Dorsal fin continuous, normally with 9 spines; anal normally with 3 spines. ENNEACANTHUS, 456.

*ii.* Dorsal fin angulated, some of the median spines elevated; dorsal spines 10; anal 3. MESOGONISTIUS, 457.

*hh.* Caudal margin concave; opercle prolonged behind in a convex process or flap which is always black; dorsal spines normally 10; anal 3.

*j.* Supplemental bone of maxillary perfectly distinct. APOMOTIS, 458.

*jj.* Supplemental bone of maxillary rudimentary or wanting.

*k.* Lower pharyngeals narrow, the teeth usually sharp, not conical. LEPOMIS, 459.

*kk.* Lower pharyngeals broad and concave, especially in the adult; teeth more or less blunt and paved. EUPOMOTIS, 460.

MICROPTERINÆ:

*cc.* Body comparatively elongate, the depth in the adult about ⅓ the length; dorsal fin low, deeply emarginate, with 10 spines; mouth large; caudal lunate. MICROPTERUS, 461.

## 450. POMOXIS, Rafinesque.

### (CRAPPIES.)

*Pomoxis*, RAFINESQUE, Amer. Month. Mag., 1818, 41, (*annularis*).
*Pomoxys*, HOLBROOK, Ichth. South Carolina, 29, 1860, (change of spelling).
*Hyperistius*, GILL, Amer. Journ. Sci. and Arts, 1864, 92, (*hexacanthus* = *carolinensis*).

Body more or less elongate, strongly compressed, the snout projecting. Mouth large, oblique; maxillary broad, with a well-developed supplemental bone. Teeth on vomer, palatines, entopterygoids, and tongue. Lower pharyngeals narrow, with sharp teeth. Gill rakers long and slender, numerous. Opercle emarginate; preopercle and preorbital finely serrated. Scales large, feebly ctenoid. Fins large, the anal larger than dorsal, of 6 spines and about 17 rays; dorsal with 6 to 8 graduated spines, the spinous dorsal shorter than the soft part; caudal fin emarginate; pectorals rounded or obtusely pointed, with 15 or 16 rays, the upper longest. Ventrals close together, each with a strong spine. Branchiostegals 7. Lateral line complete, the tubes straight and extending at least on the anterior half at the exposed surface of the scale. Posterior processes of the premaxillaries not extending to the frontals; supraoccipital and parietal crest very strong produced forward on the frontals to between the orbits; vertebræ $18 + 15 = 33$. (πῶμα, opercle; ὀξύς, sharp; the opercle ending in two flat points instead of an "ear-flap.")

*a.* Dorsal spines 6, rarely 5; anal fin plain; profile of head more strongly S-shaped than in *sparoides*. ANNULARIS, 1381.

*aa.* Dorsal spines 7, rarely 8; anal fin strongly reticulated. SPAROIDES, 1382.

### 1381. POMOXIS ANNULARIS,* Rafinesque.

(Crappie; Bachelor; New Light; Campbellite; Sac-a-lait; Crapet.)

Head 3; depth 2½; eye large, 4, reaching past pupil. D. VI, 15; A. VI, 18; scales 36 to 48. Body elongate. Head long, the profile more or less strongly S-shaped, owing to the projecting snout, depressed occipital region, and very prominent thickened antedorsal area. Mouth very wide. Scales on cheeks in 4 or 5 rows. Color silvery olive, mottled with dark green, the dark marks chiefly on the upper part of the body and having a tendency to form narrow vertical bars; dorsal and caudal fins marked with green; anal fin pale, nearly plain. Fins very high, but lower than in *Pomoxis sparoides*. Length 12 inches. Very variable. Middle United States from the Great Lakes south to Texas and west to Kansas and Nebraska; generally common, especially in sluggish waters, in ponds, and bayous; it strongly resembles its equally abundant congener, but the two do not intergrade so far as we have seen. (*annularis*, having rings.)

*Pomoxis annularis*, Rafinesque, Amer. Month. Mag., 1818, 41, Falls of the Ohio River; Bollman, Review of the Centrarchidæ, 560, pl. 68, fig. 3, 1892; Jordan & Gilbert, Synopsis, 464, 1883.

*Cichla storeria*, Kirtland, Report Zoöl. Ohio, 191, 1838, Ohio River.

*Promoxis nitidus*, Girard, Proc. Ac. Nat. Sci. Phila., 1857, 200, Houston River, Kentucky.

*Pomoxys brevicauda*, Gill, Proc. Ac. Nat. Sci. Phila., 1865, 64, North Grand River, Missouri.

*Pomoxys intermedius*, Gill, Proc. Ac. Nat. Sci. Phila., 1865, 64, no locality.

*Pomoxys protacanthus*, Gill, Proc. Ac. Nat. Sci. Phila., 1865, 66, Tarboro, North Carolina.

### 1382. POMOXIS SPAROIDES (Lacépède).

(Calico Bass; Grass Bass; Barfish; Strawberry Bass.)

Head 3; depth 2. D. VII or VIII, 15; A. VI, 17 or 18; scales 40 to 45, 6 rows on cheek. Body oblong, elevated, much compressed. Head long, its profile not strongly S-shaped, the projection of the snout and antedorsal region and the depression over the eye being less marked than in *Pomoxis annularis*. Mouth smaller than in *P. annularis*, the maxillary reaching about to the posterior edge of pupil, the mandible shorter than pectorals. Fins very high; anal higher than dorsal, its height 4–5 times in length of body. Color silvery olive, mottled with clear olive green, the dark mottlings gathered in irregular small bunches, and covering the whole body; vertical fins with dark olive reticulations surrounding pale spots; the anal marked like the dorsal; a dusky opercular spot. Length 12 inches. Great Lakes and Upper Mississippi Valley to New Jersey, and southward to Florida, Louisiana, and Texas; chiefly in lowland streams and lakes, abundant; a handsome fish, valued as food; it frequents chiefly cold and clear waters, being rarely seen in muddy bayous. (*σπάρος*, *Sparus*; *εἶδος*, resemblance.)

*Labrus sparoides*, Lacépède, Hist. Nat. Poiss., iii, 517, 1802, South Carolina.

*Cantharus nigromaculatus*, Le Sueur MS., in Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 88, 1829, Wabash River.

*Centrarchus hexacanthus*, Cuvier & Valenciennes, Hist. Nat. Poiss., vii, 459, 1831, Charleston, South Carolina.

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*This perfectly well-marked species is confounded with *Pomoxis sparoides* by Dr. Boulenger.

*Hyperistius carolinensis* GILL, Amer. Journ. Sci. and Arts., 1864, 93, South Carolina.
*Pomoxys sparoides* JORDAN & GILBERT, Synopsis, 465, 1883; BOULENGER, Cat., I, 7.
*Pomoxis sparoides*, BOLLMAN, *l. c.*, 559, pl. 68, fig. 2.

## 451. CENTRARCHUS, Cuvier & Valenciennes.

(ROUND BASS.)

*Centrarchus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., III, 84, 1829, (*irideus*).
*Eucentrarchus*, GILL, Amer. Jour. Sci. and Arts, 1864, 93, (*irideus*).

Body short and deep, compressed. Mouth moderate, the lower jaw the longer; maxillary with a well-developed supplemental bone. Teeth on vomer, palatines, entopterygoids, ectopterygoids, and tongue. Opercle emarginate behind. Gill rakers setiform, very long, finely dentate, in large number (20 to 30 below angle of arch). Fins large; the dorsal and anal fins about equal in extent, the soft portion of the latter longest and most posterior, the 2 fins being obliquely opposed; dorsal fin with the spinous part longer than the soft part, of about 12 spines, which are not rapidly graduated; anal fin with about 8 spines. Scales large, not strongly ctenoid. Lateral line complete, the tubes straight and occupying at least half of the exposed surface of the scales. Posterior processes of the premaxillaries extending nearly to the frontals; frontals posteriorly with a transverse ridge, connecting the parietal and supraoccipital crests, which are very strong and extend forward to between the orbits. Vertebræ $15 + 16 = 31$. (κέντρον, spine; ἀρχός, anus, from the development of the anal spines.)

### 1383. CENTRARCHUS MACROPTERUS (LACÉPÈDE).

(ROUND SUNFISH ; FLIER.)

Head $2\frac{3}{4}$ to 3; depth $1\frac{7}{8}$ to 2; eye large, $3\frac{1}{4}$ to 4 in head. D. XI to XIII, 12 to 14; A. VII or VIII, 15; scales large, 5 or 6–38 to 45–15, 4 to 6 rows on cheeks. Body ovate, strongly compressed; head small; snout short, shorter than eye; mouth small, oblique; maxillary reaching posterior border of pupil; lingual teeth in 2 patches; opercular spot narrow, much higher than long; dorsal high, longest spine $1\frac{3}{4}$ in head; pectorals and ventrals long, reaching anal, ventral spines extending past anus to fin. Gill rakers $x + 30$. Green, with series of dark brown spots on sides below lateral line, forming interrupted longitudinal lines; a dark spot below eye; soft dorsal and anal reticulated; young with a black ocellus at base of soft dorsal. Lowland streams and bayous from Virginia southward to Florida and Louisiana; northward in the Mississippi valley to southern Illinois; locally abundant in clear waters; a handsome fish, rarely exceeding 6 inches in length. (μακρός, long; πτερόν, fin.)

*Labrus macropterus*, LACÉPÈDE, Hist. Nat. Poiss., III, 447, 1802, Charleston, South Carolina.
*Labrus irideus*, LACÉPÈDE, Hist. Nat. Poiss., III, 716, 1802, Charleston, South Carolina.
*Centrarchus macropterus*, JORDAN & GILBERT, Synopsis, 463, 1883; BOLLMAN, *l. c.*, 558, pl. 68, fig. 1; BOULENGER, Cat., I, 8.

## 452. ACANTHARCHUS, Gill.

*Acantharchus*, GILL, Amer. Journ. Sci. and Arts, 1864, 92, (*pomotis*).

Body oblong, robust, not much compressed or elevated. Mouth not very large, the broad maxillary with a well-developed supplemental bone; lower jaw projecting. Teeth on vomer, palatines, pterygoids, and tongue; lingual teeth in a single patch; pharyngeal teeth sharp. Gill rakers few, rather long and strong. Opercle emarginate; preopercle entire. Scales cycloid, large. Lateral line complete. Dorsal spines usually 11; anal spines 5; caudal fin rounded behind. Close to *Ambloplites*, differing chiefly in the rounded caudal. One species known. (*ἄκανθα*, spine; *ἀρχός*, anus.)

### 1384. ACANTHARCHUS POMOTIS (Baird).

(MUD SUNFISH.)

Head 2⅔; depth 2; eye not very large, 3½ to 4 in head. D. XI or XII, 10 or 11; A. V, 10; scales 6–43–12, about 5 rows on cheek. Body oblong, moderately compressed. Snout short. Mouth wide, the gape short; the maxillary reaching posterior part of orbit; lingual teeth in 1 patch. About 5 gill rakers besides rudiments. Dorsal spines low, the longest about as long as from snout to middle of pupil. Pectoral 1⅔ in head. Color very dark greenish; body usually with 5 rather indistinct blackish longitudinal bands along the sides; cheeks with dark bands, which run nearly parallel, the lowest passing across the maxillary around the front part of the lower jaw; fins plain dusky; a black opercular spot. Length 6 inches. Southern New York to South Carolina, in sluggish streams near the coast; locally common, especially in the Delaware River; a small species of little value as food. (*Pomotis*, the sunfish, a synonym of *Lepomis*.)

*Centrarchus pomotis*, BAIRD, Ninth Smithson. Report, 325, 1854, New Jersey; New York; (Coll. Baird); GÜNTHER, Cat., I, 256, 1859.

*Acantharchus pomotis*, JORDAN & GILBERT, Synopsis, 469, 1883; BOLLMAN, *l. c.*, 563, pl. 70, fig. 1.

*Ambloplites pomotis*, BOULENGER, Cat., I, 11.

## 453. AMBLOPLITES, Rafinesque.

(ROCK BASS.)

*Ambloplites*, RAFINESQUE, Ichth. Oh., 33, 1820, (*ichtheloides* = *rupestris*).

Body oblong, moderately elevated, compressed. Mouth large, the broad maxillary with a well-developed supplemental bone; lower jaw projecting. Teeth on vomer, palatines, tongue, entopterygoids, and ectopterygoids; lingual teeth in a single patch; pharyngeal teeth sharp. Branchiostegals 6. Opercle ending in 2 flat points; preopercle serrate at its angle; other membrane bones chiefly entire. Gill rakers rather long and strong, dentate, less than 10 in number, developed only on the lower portion of the arch. Scales large, somewhat ctenoid; lateral line complete, the tubes occupying at least the anterior half of the surface of the scale. Dorsal fin much more developed than the anal fin, with 10 or 11 rather low spines; anal spines normally 6; pectorals obtusely pointed with 14 or 15 rays, the upper longest. Caudal fin emarginate. (*ἀμβλύς*, blunt; *ὁπλίτης*, armature.)

### 1385. AMBLOPLITES RUPESTRIS (Rafinesque).

(Common Rock Bass; Red-eye; Goggle-eye.)

Head 2¾; depth 2–2½; eye very large, 3½ in head. D. XI, 10; A. VI, 10; scales about 5–39–12, 6 to 8 rows on cheeks. Cœca 7. Vertebræ 14 + 18. Body oblong, moderately compressed. Head large, the profile little depressed above the eye. Mouth large, the maxillary extending to opposite posterior part of pupil; lingual teeth in 1 patch. Gill rakers few, 7 to 10, developed on lower part of arch; preopercle serrate near its angle. Color olive green, brassy-tinged, with much dark mottling; the young irregularly barred and blotched with black, the adult with a dark spot on each scale, these forming interrupted black stripes; a black opercular spot; dark mottlings on the soft dorsal, anal, and caudal. Length 12 inches. Vermont to Great Lake region and Manitoba, south to Louisiana; very abundant west of the Alleghanies; a gamy fish, valued as food. (*rupestris*, living among rocks.)

*Bodianus rupestris*, Rafinesque, Am. Monthly Mag., 1817, 120, Lakes of New York, Vermont, and Canada.

*Ichthelis erythrops*, Rafinesque, Ichth. Ohiensis, 29, 1820, Ohio River.

*Lepomis ichtheloides*, Rafinesque, Ichth. Ohiensis, 32, 1820, Ohio River.

*Cichla ænea*, Le Sueur, Jour. Ac. Nat. Sci. Phila., 1822, 214, Lake Ontario.

*Centrarchus pentacanthus*, Cuvier & Valenciennes, Hist. Nat. Poiss., III, 88, 1829, Wabash River.

*Centrarchus æneus*, Cuvier & Valenciennes, Hist. Nat. Poiss., III, 84, 1829.

*Ambloplites rupestris*, Jordan & Gilbert, Synopsis, 466, 1883; Bollman, *l. c.*, 561, pl. 69, fig. 2; Boulenger. Cat., I, 10.

Represented in the Roanoke River, east of the Alleghanies, by an isolated colony,

### 1385a. AMBLOPLITES RUPESTRIS CAVIFRONS, Cope.

Scales on cheek minute and embedded, wholly invisible over most of the area; profile concave over the eyes. Differing in no other particular from *Ambloplites rupestris*. Roanoke River, Virginia. (*cavus*, concave; *frons*, forehead.)

*Ambloplites cavifrons*, Cope, Jour. Ac. Nat. Sci. Phila., 1868, 217, Roanoke River. (Coll. Cope.)

*Ambloplites rupestris cavifrons*, Bollman, *l. c.*, 561.

## 454. ARCHOPLITES, Gill.

*Archoplites*, Gill, Proc. Ac. Nat. Sci. Phila., 1861, 165, (*interruptus*).

Body oblong, compressed, the back elevated. Mouth large, oblique, the broad maxillary with a well-developed supplemental bone. Teeth on jaws, vomer, palatines, tongue, ectopterygoids, and entopterygoids; lingual teeth in 2 patches; pharyngeal teeth pointed. Gill rakers long and strong, compressed, numerous, about 20 in number, some of them on the upper portion of the arch. Branchiostegals 7. Operculum emarginate, the lower point much the larger, striate, the ridges terminating in small spines; preopercle, interopercle, subopercle, suborbital, and preorbital with their inferior edges conspicuously serrate; dentaries and preopercle with large muciferous depressions or pits. Dorsal fin with about 13 spines; anal usually with 7 spines. Caudal emarginate. Scales strongly ctenoid. California. (ἀρχός, anus; ὁπλίτης, armature.)

### 1386. ARCHOPLITES INTERRUPTUS (Girard).

(Sacramento Perch.)

Head 2⅔; depth 2½; eye very large, 4 to 5 in head. D. XII or XIII, 10; A. VI or VII, 10; scales about 7–40 to 51–14, about 8 series on cheek. Body oblong, ovate, compressed, the back considerably elevated anteriorly, depressed over the eye, the snout projecting at an angle. Mouth terminal, very large, the maxillary very broad, extending beyond pupil. Dorsal spines rather low, strong; anal spines similar; pectoral short, barely reaching anal. Color blackish above, sides silvery, with about 7 vertical blackish bars, irregular in form and position and more or less interrupted; body sometimes almost wholly black; sometimes brassy; a black opercular spot; fins nearly plain. Length 1 to 2 feet. Sacramento and San Joaquin rivers and tributary lakes; abundant; the only fresh-water Percoid west of the Rocky Mountains; an excellent food-fish, now being exterminated by the carp and catfish, which infest its spawning grounds. (*interruptus*, interrupted.)

*Centrarchus interruptus*, Girard, Proc. Ac. Nat. Sci. Phila., 1854, 129, San Joaquin and Sacramento rivers. (Colls. Drs. Heermann and Newberry.)

*Centrarchus maculosus*, Ayres, Proc. Cal. Ac. Nat. Sci., I, 1854, 8, Sacramento River.

*Ambloplites interruptus*, Girard, Pac. R. R. Surv., x, 10, pl. 2, figs. 1–4, 1858; Boulenger, Cat., I, 12.

*Archoplites interruptus*, Jordan & Gilbert, Synopsis, 466, 1883; Bollman, 560, pl. 69, fig. 1.

## 455. CHÆNOBRYTTUS, Gill.

(Warmouths.)

*Chænobryttus*, Gill, Amer. Journ. Sci. Arts, 92, 1864, (*melanops* = *gulosus*).

*Glossoplites*, Jordan, Manual of Vertebrates, Ed. I, 223, 1876, (*melanops*).

This genus has the general form and dentition of *Ambloplites* with the convex opercle, 10 dorsal and 3 anal spines of *Lepomis*. Preopercle entire. Branchiostegals 6. Caudal fin emarginate. Scales weakly ctenoid. Vertebræ 13 + 16 = 29. Posterior processes of the premaxillaries extending nearly to the frontals; frontals posteriorly with a transverse ridge connecting the parietal and supraoccipital crest, which are very strong. (χαίνω, to yawn; *Bryttus*, i. e. *Lepomis*.)

### 1387. CHÆNOBRYTTUS GULOSUS (Cuvier & Valenciennes).

(Warmouth; Goggle-eye.)

Head $2\frac{1}{5}$ to $2\frac{3}{8}$; depth 2 to $2\frac{1}{2}$; eye 4 to $4\frac{1}{2}$. D. X, 9 or 10; A. III, 8 or 9; scales 6–40 to 46–11 or 12; 37 to 42 pores; 6 to 8 rows on cheek. Body heavy, deep, more elongate than in *Lepomis*; head large, snout about equal to eye; mouth large, maxillary reaching posterior border of eye; opercular spot about as large as eye. Dorsal spines low, longest reaching to middle of pupil from tip of snout; pectoral not reaching origin of anal fin; ventrals nearly reaching anus, ventral spine about 2 in distance between origin of ventral and anus. Gill rakers 8 or 9 besides rudiments. Dark olive-green, clouded with darker, usually with red or blue, and brassy; a dusky spot on each scale more or less distinct; vertical fins mottled with dusky; a faint spot on last rays of dorsal, bordered by paler; 3 oblique dusky or reddish bars radiating from eye; belly yellowish or brassy. Length 8 to 10 inches. Eastern United States from the Great Lakes to Carolina and Texas and west to Kansas and Iowa. Chiefly west or south of the Alleghanies; common in South Carolina. A very voracious species, variable in form and color. (*gulosus*, large-mouthed.)

*Pomotis gulosus*, Cuvier & Valenciennes, Hist. Nat. Poiss., III, 498, 1829, Lake Pontchartrain and lagoons about New Orleans.

*Centrarchus viridis*, Cuvier & Valenciennes, Hist. Nat. Poiss., VII, 460, 1831, Charleston, South Carolina.

*Calliurus punctulatus*, Agassiz, Amer. Jour. Sci. and Arts. 1854, 300, Huntsville, Alabama.

*Calliurus floridensis*, Holbrook, Jour. Ac. Nat. Sci. Phila., 1855, 53, St. Johns River, Florida.

*Calliurus melanops*, Girard, Proc. Ac. Nat. Sci. Phila., 1857, 200, Leon and Medina rivers, and Dry and San Pedro creeks, Texas.

*Lepomis charybdis*, Cope, Jour. Ac. Nat. Sci. Phila., 1868, 224, Texas.

*Lepomis gillii*, Cope, Jour. Ac. Nat. Sci. Phila., 1868, 225, James River, Virginia.

*Chænobryttus antistius*, McKay, Proc. U. S. Nat. Mus., 1881, 88, Lake Michigan, at Chicago; (Coll. Jordan); specimens with dorsal spines a little more anterior than usual; Jordan & Gilbert, Synopsis, 467, 1883.

*Chænobryttus gulosus*, Jordan & Gilbert, Synopsis, 468 1883; Bollman, *l. c.*, 562, pl. 69, fig. 3; Boulenger, Cat., I, 13.

## 456. ENNEACANTHUS,* Gill.

*Enneacanthus*, Gill, Amer. Jour. Sci. and Arts. 92, 1864, (*obesus*).

*Hemioplites*, Cope, Jour. Ac. Nat. Sci. Phila., 1868, 218, (*simulans* = *gloriosus*).

*Copelandia*, Jordan, Proc. Ac. Nat. Sci. Phila., 1877, 56, (*eriarcha*).

Body rather short and deep, compressed. Mouth small; the supplemental maxillary bone well developed. Teeth on vomer and palatines, none on the tongue. Opercle ending behind in 2 flat points, with a dermal border. Preopercle entire. Scales rather large, the lateral line sometimes interrupted. Gill rakers short, 9 or 10 below angle of arch. Dorsal fin continuous, normally with 9 spines; anal fin smaller than the dorsal, with 3 spines; caudal fin convex behind. Branchiostegals 6. Species of small size and bright coloration, intermediate between *Lepomis* and *Centrarchus*. Abnormal variations in the number of dorsal and anal spines have given rise to the nominal genera *Hemioplites* and *Copelandia*. (*ἐννέα*, nine; *ἄκανθα*, spine.)

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* Concerning this genus McKay remarks: "This genus, *Enneacanthus*, Gill, as understood by me, includes *Hemioplites* and *Copelandia*. The genus *Hemioplites* was based by Cope on the presence of 8 spines in the dorsal fin and 4 in the anal. I learn from Professor Jordan's notes that Cope's original type of *Hemioplites simulans* has really 9 spines in the dorsal. Dr. Edward J. Nolan, who has recently examined the specimen, also informs me that there are 9 spines in the dorsal. In a collection of young specimens of *Enneacanthus margarotis* from Virginia, which I have examined in the National Museum, there are several specimens with the fin formula D. 9, A. 4, several with the formula D. 10, A. 4, and the remainder with the formula D. 9, A. 3. That is, some of these specimens, all collected at the same time and evidently of the same species, were *Enneacanthus margarotis*, others were *Hemioplites simulans*, and the remainder would represent a second species of *Copelandia*. In 120 specimens of *Enneacanthus margarotis*, examined by me the results were as follows: 13 specimens with D. 8, A. 3; 89 specimens with D. 9, A 3; 9 specimens with D. 10, A. 3; 5 specimens with D. 10, A. 4; 4 specimens with D. 9, A. 4. In the examination of 53 specimens of *Enneacanthus obesus* the following results were obtained: 4 specimens with D. 8, A. 3; 46 specimens with D. 9, A. 3; 2 specimens with D. 10, A. 3; 1 specimen with D. 10, A. 4."—*McKay, Proc. U. S. Nat. Mus., 1881, 92.*

*a.* Opercular spot large, more than half eye; sides with 5 to 8 distinct vertical black bars. OBESUS, 1388.

*aa.* Opercular spot smaller than half eye; body with the crossbars narrower and less distinct, usually disappearing with age; male with head, body, and vertical fins with round sky-blue spots; female duller with lower fins and larger faint spots. GLORIOSUS, 1389.

### 1388. ENNEACANTHUS OBESUS (Baird).

Head 2⅔; depth 1⅘; eye 3¼ in head. D. IX, 10; A. III, 10; scales 4–32–10, the pores developed usually on about 20 scales, but sometimes on nearly all of them. Body oblong, ovate, elliptical. Scales large, little crowded. Gill rakers x + 9 or 10. Dorsal spines 2½ in head, as long as from snout to posterior margin of eye; anal fin large; ventral spine not reaching vent, its first ray not reaching the base of the last anal spine; caudal fin moderate, about as long as from snout to middle of opercle; opercular spot rather large, more than half the size of eye, velvet black, bordered with purple. Cheeks with 4 rows of scales. Color olivaceous, with 5 to 8 well-defined blackish cross bars, not disappearing with age; spots on body and fins purplish or golden; cheek with lines and spots; a dark bar below eye. Length 3 inches. Charles River, Massachusetts, to Florida; abundant in sluggish streams near the coast; usually larger in size and duller in color than the next, the two closely related but apparently not intergrading. (*obesus*, fat.)

*Pomotis obesus*, BAIRD, Ninth Smithson. Report, 1854, 324, Beesley Point, New Jersey. (Coll. Baird.)

*Bryttus fasciatus*, HOLBROOK, Jour. Ac. Nat. Sci. Phila., 1855, 51, St. Johns River, Florida; GÜNTHER, Cat., I, 260, 1859.

*Pomotis guttatus*, MORRIS, Proc. Ac. Nat. Sci. Phila., 1859, 3, Delaware River, Philadelphia.

*Enneacanthus obesus*, JORDAN & GILBERT, Synopsis, 470, 1883; BOLLMAN, *l. c.*, 564.

*Apomotis obesus*, BOULENGER, Cat., I, 19.

### 1389. ENNEACANTHUS GLORIOSUS (Holbrook).

Head 2¾; depth 2¼; eye 3¼ in head. D. IX, 10; A. III, 9 (occasionally D. X, or A. IV, in abnormal specimens, these often abundant in certain streams); scales 3–30–9. Body comparatively elongate. Mouth moderate, very oblique, the maxillary reaching just past front of orbit. Dorsal spines medium; soft rays in the males somewhat elevated, reaching to or beyond (var. *pinniger*) the base of the caudal; the longest soft ray as long as from snout to front of opercle, or (var. *pinniger*) as long as head; fins in females all lower; pectoral fin reaching nearly to middle of anal. Gill rakers x + 9 or 10. Lateral line usually, but not always, complete. Color dark olive; young with traces of narrow vertical, darker bars; ear flap small, with a blue border and a pearly spot in front; a dark bar about width of pupil extending obliquely downward below eye; sides of head, whole body and vertical fins, in the males, with round bright blue spots arranged in irregular rows, these spots most distinct on the cheeks and opercles and on the lower part of the sides; females duller, with larger and fainter spots more regular in position; a dark bar below eye. Length 2¾ inches. New Jersey to Florida, in clear, sluggish streams; a beautiful little fish. (*gloriosus*, glorious).

*Bryttus gloriosus*, Holbrook, Jour. Ac. Nat. Sci. Phila., 1855, 51, Cooper River, South Carolina.

*Hemioplites simulans*, Cope, Jour. Ac. Nat. Sci. Phila., 1868, 218, Tuckahoe Creek, near Richmond, Virginia. (Coll. Cope.)

*Enneacanthus pinniger*, Jordan, Bull. x, U. S. Nat. Mus., 27, 1877, Tar River, Kinston, North Carolina; specimens with bright colors and very high fins; probably not worthy of varietal distinction.

*Enneacanthus margarotis*, Gill & Jordan, Bull. x, U. S. Nat. Mus., 28, 1877, Beesley Point, New Jersey.

? *Copelandia*[*] *criarcha*, Jordan, Proc. Ac. Nat. Sci. Phila., 1878, 56, type specimen received from Dr. Philo R. Hoy, said to be from Menomonee River, near Milwaukee, Wisconsin; this is probably an error, and the specimens really came from New Jersey.

*Enneacanthus simulans*, Jordan & Gilbert, Synopsis, 470, 1883.

*Enneacanthus gloriosus*, Bollman, *l. c.*, 564.

*Enneacanthus eriarchus*, Jordan & Gilbert, Synopsis, 469, 1883; Bollman, *l. c.*, 564.

## 457. MESOGONISTIUS,[†] Gill.

### (Banded Sunfishes.)

*Mesogonistius*, Gill, Amer. Jour. Sci. and Arts., 1864, 92, (*chætodon*).

Body short and deep, compressed. Mouth small. Teeth present on vomer and palatines, none on the tongue; supplemental maxillary bone small. Gill rakers rather strong, dentate. Opercle ending in two flat points, with a dermal border; preopercle entire. Scales large. Dorsal with 10 spines; outline of the fin angulated, the middle spines being much longer than some of the posterior ones; anal fin much smaller than the dorsal, with 3 spines; caudal fin posteriorly rounded; pectoral obtusely pointed, the upper rays longest. Size small. (*μέσος*, middle; *γωνία*, angle; *ἱστίον*, sail.)

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[*] *Enneacanthus eriarchus* (Jordan):

Dorsal X, 7; anal IV, 8; scales 33. Ventral spine reaching anal. Olivaceous; vertical fins with round, pale spots. Only two specimens known; the original type, purporting to be from Milwaukee, Wisconsin, another from Tabo Creek, Missouri. Both these specimens were received from Dr. P. R. Hoy. There is no doubt a confusion of localities, and probably both came from Delaware River, perhaps from Dr. Abbott's collection. This is especially probable, as a specimen of *Stolephorus brownii* was found in the same collection, also attributed to Milwaukee.

[†] Dr. Boulenger unites this genus and *Enneacanthus* with *Apomotis*. In our judgment *Apomotis* is scarcely distinct from *Lepomis*, with which genus *Mesogonistius* and *Enneacanthus* have no very close affinities.

### 1390. MESOGONISTIUS CHÆTODON (Baird).

(Black-banded Sunfish.)

Head 3; depth 1⅔; eye large, 3 in head. D. X, 10; A. III, 12; scales 4–28–10. Body suborbicular, compressed. Head moderate, the profile nearly concurrent with the dorsal curve. Mouth very small, the maxillary reaching nearly to the eye. Cheeks with 3 or 4 rows of scales. Fins rather large; dorsal fin high in front, the middle portion depressed. Gill rakers short, x + 10 or 11. Pectoral 1⅓ in head; fourth dorsal spine 2 to 2½. Lateral line continuous. Coloration clouded straw color, the sides with 6 to 8 conspicuous but rather irregular black vertical bars, the first through the eye, the second in front of pectorals, interrupted on the operculum, the third at the front of the dorsal covering the membrane of the first 3 spines and forming a medial black stripe on each ventral fin, the fourth at front of soft dorsal, the fifth opposite its last ray, the last at the base of the caudal; black opercular spot, with a crescent-shaped paler center; fins mottled. Length 4 inches. New Jersey to Maryland, in sluggish streams. A very handsome little fish; locally abundant, but very narrow in its range. (*Chætodon*, a genus of marine fishes, with similar cross bands.)

*Pomotis chætodon*, Baird, Ninth Smithson. Report, 1854, 324, Cedar Swamp Creek, New Jersey; (Coll. Baird.) Günther, Cat., i, 263, 1859.

*Mesogonistius chætodon*, Jordan & Gilbert, Synopsis, 471, 1883; Bollman, *l. c.*, 565.

*Apomotis chætodon*, Boulenger, Cat., i, 19.

## 458. APOMOTIS, Rafinesque.

*Apomotis*, Rafinesque, Journal de Physique, etc., Paris, 420, 1819, (*cyanellus*).

*Telipomis*, Rafinesque, Ichth. Ohiensis, 27, 1820, (*cyanellus*).

*Bryttus*, Cuvier & Valenciennes, Hist. Nat. Poiss., vii, 461, 1831, (*punctatus*).

*Calliurus*, Girard, U. S. Mex. Bound. Surv., Ichth., 5, 1859, (not of Rafinesque).

This genus is very close to *Lepomis*, from which it differs only in the development of the supplementary maxillary bone, which becomes rudimentary or wanting in the adult of *Lepomis*. The mouth is largest in the species in which this bone is best developed. Lower pharyngeals narrow, with acute teeth; gill rakers well developed, long and stiff; pectoral bluntish, shorter than head; scales moderate, 43 to 50. Species widely distributed in American waters, similar in habit to the species of *Lepomis*. (*ἀ*, without; *πῶμα*, opercle; *οὖς*, ear.)

*a.* Body oblong, the depth 2⅓ to 2½ in length; dorsal with a more or less distinct black spot at base of last soft rays; opercular spot margined with bright colors, the black confined to bony part; scales 45 to 55; supplemental maxillary well developed. CYANELLUS, 1391.

*aa.* Body short and deep, the depth about 2 in length.
  *b.* Scales 40 to 46; opercular spot as large as eye, margined above and below.
    *c.* Eye 4½ to 5 in head; body not covered with brown spots.
      *d.* Color dusky olive, with some red and bluish, a faint spot at base of last dorsal rays. ISCHYRUS, 1392.
      *dd.* Color plain olive; no spots on the fins. PHENAX, 1393.

*cc.* Eye 3½ to 3⅔ in head; color olive, usually with many dark bronze spots like fly specks scattered over the body; no black spot on last rays of dorsal and anal. PUNCTATUS, 1394.

*bb.* Scales large, 33 to 35; color green, with darker bars; dorsal fin usually with a black ocellated spot at base of last rays. SYMMETRICUS, 1395.

### 1391. APOMOTIS CYANELLUS (Rafinesque).

(BLUE-SPOTTED SUNFISH; GREEN SUNFISH; LITTLE RED-EYE.)

Head 3; depth 2½. D. X, 11; A. III, 9; scales small, 6 or 7–45 to 55–16; 40 to 48 pores; 8 rows on cheek. Body oblong, rather elongate, becoming short and deep with age; moderately compressed. Head large, with projecting snout. Mouth rather large, the maxillary broad and flat, with a small supplemental bone, reaching nearly to middle of eye; lower jaw projecting. Dorsal spines quite low, the highest scarcely longer than snout, 3 to 4 in head in the adult, longer in the young. Opercular spot small, less than eye, broadly margined with bronze, the black confined to the bony part. Gill rakers moderate, x + 13. Pectoral short, not reaching anal, 1½ in head; ventrals not reaching vent. Color variable, the prevailing shade green with a strong brassy luster on sides, which becomes nearly yellow below; each scale usually with a sky-blue spot and more or less of gilt edging, giving an appearance of pale lateral streaks; besides these marks, dusky or obscure vertical bars are often present, and the sides are sprinkled with dark dots; vertical fins marked with blue or green, the anal usually edged in front with pale orange; usually a conspicuous black spot on posterior base of dorsal and anal, these often obsolete; iris red; cheeks with narrow blue stripes. Length 7 inches. Very variable. Great Lake region to Mexico; very abundant from Ohio southwestward to the Rio Grande; ascending small brooks; not found east of the Alleghanies. (κυάνεος, blue.)

*Lepomis cyanellus*, RAFINESQUE, Journ. de Physique, 1819, 420, Ohio River; JORDAN & GILBERT, Synopsis, 474, 1883; BOLLMAN, *l. c.*, 569; EVERMANN & KENDALL, Bull. U. S. Fish Comm., XII, 1892 (1894), 111.

*Icthelis melanops*, RAFINESQUE, Ichth. Ohiensis, 28, 1820, Ohio River.

*Pomotis longulus*, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1853, 391, Otter Creek, Arkansas; (Coll. Capt. Geo. B. McClellan).

*Calliurus diaphanus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 200, 1857, Rio Blanco, Texas.

*Calliurus formosus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 200, 1857, Arkansas.

*Calliurus microps*, GIRARD, Proc. Ac. Nat. Sci. Phila., 200, 1857, Rio Blanco, Texas.

*Calliurus murinus*,* GIRARD, Proc. Ac. Nat. Sci. Phila., 200, 1857, Texas; (Type, No. 415).

*Bryttus signifer*, GIRARD, Proc. Ac. Nat. Sci. Phila., 201, 1857, Rio Medina, Texas.

*Bryttus mineopas*, COPE, Proc. Ac. Nat. Sci. Phila., 84, 1865, Whittlesey Lake, Minnesota.

*Calliurus longulus*, GIRARD, Rept. U. S. Mex. Bound. Surv., Ichth., 5, pl. IV, figs. 1–4, 1859.

*Apomotis cyanellus*, BOULENGER, Cat., I, 21.

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*The specimens called *Calliurus murinus* by Girard are nearly all the ordinary *cyanellus*. One of them (No. 415, U. S. N. M.) differs somewhat and has been regarded by McKay as a distinct species, thus described:

*Apomotis murinus* (Girard): Head 2⅗; depth 3. D. X, 10; A. III, 9; scales 7–42–15. Body elongate, somewhat compressed, the form precisely as in *Apomotis cyanellus*. Mouth rather large; maxillary about reaching front of eye; teeth on vomer and front of palatines. Gill rakers moderate, 9 or 10 developed. Supplemental maxillary scarcely appreciable. Eye equal to interorbital width. Cheeks with 7 rows of scales. Spinous dorsal rather high, the longest spine about as long as from tip of snout to pupil; pectorals short, scarcely reaching vent. Scales small, reduced on breast. Dark greenish; a black spot on dorsal as in *A. cyanellus*. Characters from No. 415, U. S. Nat. Mus., from Texas; definite locality not known. (*murinus*, like a mouse, *Mus.*)

### 1392. APOMOTIS ISCHYRUS (Jordan & Nelson).

Head 2⅔; depth 2⅙; eye 4½ in head, smaller than opercular spot. D. IX or X, 12; A. III, 9 or 10. Scales 5–46–14, 6 rows on cheek. Form of *Lepomis pallidus*. Body robust, rather elevated; mouth wide, the maxillaries reaching middle of orbit; supplemental maxillary bone well developed. Palatine teeth present. Occiput prominent; top of head flat and short, forming an angle with the descending profile. Fins high; dorsal spines rather low and strong, the longest equal to distance from tip of snout to middle of orbit; opercular flap large, entirely surrounded by a broad pale edge. Gill rakers long. Color in spirits dusky olive, mottled with orange and blue; cheeks with broad, faint blue bands; a dusky spot on dorsal and anal behind; belly and lower fins coppery yellow; lower jaw and lower parts of head leaden blue. Length 7 inches. Upper Mississippi Valley; rare, known only from western Illinois. (ἰσχυρός, robust.)

*Lepiopomus ischyrus*, JORDAN & NELSON, Bull. U. S. Nat. Mus., x, 25, 1877, Illinois River; (Coll. S. A. Forbes).

*Lepomis ischyrus*, JORDAN & GILBERT, Synopsis, 474, 1883; BOLLMAN, *l. c.*, 50.

### 1393. APOMOTIS PHENAX (Cope & Jordan).

Head 2½ (3 without flap); depth 2⅕; eye small, 5; snout 4¾. D. X, 10; A. III, 9; scales 7–44–12, 7 rows on cheek. Form of *Lepomis pallidus*. Body rather short and deep; snout short, projecting, forming an angle over the eye. Mouth moderate, the lower jaw slightly the longer, the maxillary reaching pupil; the supplemental bone strong; opercular spot larger than eye. Gill rakers very long. Dorsal spines short and strong, the longest as long as from snout to middle of eye; pectorals long; soft dorsal high; anal higher. Color in spirits nearly plain olive green; no black spot on dorsal or anal. Length 6 inches. Beesley Point, New Jersey; only two specimens known (in Coll. Ac. Nat. Sci. Phila.). These specimens are referred by Bollman to *Apomotis ischyrus*, on the supposition of error in locality. We have recently been permitted* to examine the types of *A. phenax*. It seems to differ from *A. ischyrus* in the somewhat smaller eye, the smaller and less bony opercular flap, and in the coloration. Both *ischyrus* and *phenax* are well separated from *cyanellus*, but both are near *punctatus*, and more material is needed to fix the status of each. (φενάξ, deceptive, having the maxillary of *Apomotis cyanellus* and the form of *Lepomis pallidus*.)

*Apomotis phenax*, COPE & JORDAN, Bull. U. S. Nat. Mus., x, 26, 1877, Beesley Point, New Jersey; locality possibly erroneous.

*Lepomis phenax*, JORDAN & GILBERT, Synopsis, 474, 1883.

### 1394. APOMOTIS PUNCTATUS (Cuvier & Valenciennes).

Head 3; depth 1⅞; eye large, 3½ to 4 in head. D. X, 11; A. III, 10; scales 6–40 to 45–13; pores 38 to 40; 7 rows on cheek. Body deep, compressed, the profile steep; an angle above the eye. Mouth moderate;

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*Through the kindness of Dr. Edward J. Nolan of the Philadelphia Academy.

maxillary reaching past anterior margin of eye; supplemental maxillary present, small; palatine teeth present. Gill rakers rather long, stiff, and strong, x + 8 or 9. Opercular flap small, short, and deep; shorter than eye. Dorsal spines high, the middle ones highest and nearly half head, as long as snout and orbit; pectoral 1½ to 1⅓ in head, ventral reaching anal. Olivaceous, with numerous small deep brown spots, smaller than pinheads, resembling flyspecks; most distinct on lower part of the sides, where they form lines along the rows of scales, and on the opercles; sometimes they cover the whole body; spots rarely obsolete; fins plain dusky. Length 6 inches. A handsome species, known at sight by the peculiar coloration. South Carolina to Florida, in lowland streams. Not rare. (*punctatus*, spotted.)

*Bryttus punctatus*, Cuvier & Valenciennes, Hist. Nat. Poiss., vii, 462, 1831, **Charleston, South Carolina.**

*Bryttus reticulatus*, Cuvier & Valenciennes, Hist. Nat. Poiss., 463, 1831, **Charleston, South Carolina,**

*Lepomis apiatus*, Cope, Proc. Amer. Philos. Soc., 1877, 65, **Volusia, Florida.**

*Lepomis punctatus*, Jordan & Gilbert, Synopsis, 476, 1883.

*Apomotis punctatus*, Boulenger, Cat., i, 23.

### 1395. APOMOTIS SYMMETRICUS (Forbes).

Head 2¾; depth 2¼; eye 3⅔; snout 4½. D. X, 10; A. III, 9; scales 6–35–10; tubes developed on 14 scales only; 5 rows on cheek. Body rather short and deep, the back evenly arched, a slight depression above eye; caudal peduncle stout, its least depth nearly ½ length of head. Mouth small, oblique, the maxillary reaching to vertical of eye; supplemental maxillary bone present; opercular process ⅔ diameter of eye, flexible margin narrow, the black not confined to the bony part. Lower pharyngeals broad, broader than in somewhat larger specimens of *Eupomotis gibbosus*, the teeth bluntly conic; gill rakers long and slender, the longest more than half diameter of eye. Lateral line gently arched, incomplete. Fins moderate; longest dorsal spine equal to distance from tip of snout to posterior edge of pupil; soft dorsal higher, its longest ray half length of head; pectorals long, 1⅓ in head, reaching third anal spine; ventrals short, scarcely reaching anal, or nearly twice in head; anal size of soft dorsal. Coloration in alcohol: Base of each scale on upper parts of body and along sides brown, outer margin pale, the general appearance resulting being that of 12 or 13 longitudinal rows of brown spots, 4 of which lie above the lateral line; on the caudal peduncle the spots are less regular; all parts of the body, including fins as well, covered thickly with small coffee-colored specks, the head and breast being especially thickly covered; tips of the ventral fins black; no black spot on dorsal or anal and no blue lines on cheek. Length 3 inches. Mississippi Valley, Illinois to Louisiana and Texas; a pretty little fish, not rare southward in lowland streams; here described from specimens collected by Evermann and Gurley at Houston, Texas. It shows affinities with *Eupomotis*. (*symmetricus*, a word improperly assumed as the antecedent of our *symmetrical*, for which the Greek is σύμμετρος.)

*Lepomis symmetricus*, **Forbes**, in **Jordan** & **Gilbert**, Synopsis, 473, 1883, Illinois River, (Coll. Forbes); **Bollman**, *l. c.*, 571; **Evermann** & **Kendall**, Bull. U. S. Fish Comm., XII, 1892 (1894), 111, pl. XXXII, fig. 2.

*Apomotis symmetricus*, **Boulenger**, Cat., I, 21,

## 459. LEPOMIS, Rafinesque.

### (Sunfishes.)

*Lepomis*, **Rafinesque**, Journ. de Physique, 402, 1819, (*auritus*).

*Pomotis*, **Rafinesque**, Journ. de Physique, 402, 1819, (*auritus*); the name transferred by **Cuvier** to the group of which *vulgaris* (= *gibbosus*) is type.

*Ichthelis*, **Rafinesque**, Ichth. Ohiensis, 27, 1820, (*auritus*); **Holbrook**, Ichth. S. Carolina, I, 12, 1860.

*Helioperca*, **Jordan**, Ann. Lyc. Nat. Hist. N. Y., 1876, (1877), 335, (*pallidus*).

*Erichæta*, **Jordan**, in Klippart's Rept. Fish. Comm. Ohio, 1876 (1877), 48, slip for *Helioperca*, uncorrected in proof, (*pallidus*).

*Xenotis*, **Jordan**, Proc. Ac. Nat. Sci. Phila., 1877, 76, (*fallax*).

*Lepiopomus*, **Jordan**, Ann. Lyc. Nat. Hist. N. Y., 1877, 316, (emendation of *Lepomis*).

Body oblong or ovate, more or less compressed, the back in the adult somewhat elevated. Mouth moderate or small, the jaws about equal; maxillary narrow, the supplemental bone reduced to a mere rudiment or altogether wanting. Teeth on vomer, and usually on palatines; none on tongue or pterygoids; lower pharyngeals narrow, the teeth spherical or paved, all or nearly all sharp, few or none of them conical. Gill rakers mostly short; preoperculum entire; operculum ending behind in a convex flap, black in color, which in some species becomes greatly developed with age. Branchiostegals 6. Scales moderate. Dorsal fin continuous, with 10 spines; anal with 3 spines; caudal fin emarginate; pectorals long or short; vertebræ usually $13 + 16$ or $17 = 29$ or 30. Coloration brilliant, but evanescent. A large genus, one of the most difficult in our fish fauna in which to distinguish species. The form of body, development of ear flap, and height of spines vary with age and condition, while the general appearance and the numbers of fin rays and scales are essentially the same in all. Several attempts have been made to subdivide the group,* but the characters used, drawn from the pharyngeals, gill rakers, palatine teeth, and pectoral fins are themselves subject to variation, changing or disappearing by degrees without marked gaps. The following analytical key, based largely on work of McKay, Bollman, and Boulenger, will generally serve to identify adult examples; only by careful comparison, aided by long experience, can young individuals be distinguished. As to the difficulty of defining the genera of sunfishes, McKay has the following pertinent remarks: "This genus (*Lepomis*) as understood by me, includes *Apomotis*, *Xenotis*, *Bryttus*, *Helioperca*, *Xystroplites*, and *Eupomotis* of authors. *Apomotis* has been separated from *Lepomis* on account of the large size of the supplemental maxillary. On careful comparison this is found to be scarcely larger than in one or two other species of *Lepomis*. It disappears by degrees, but seems to exist in all the species, though sometimes so small as to be inappreciable. I have even found it present in large specimens of *L. pallidus*. Its presence in the species is only a character of degree, therefore not generic. Till the group has been more fully studied *Xenotis* was supposed to contain a large number of species, and was separated from *Lepomis* principally for convenience sake, and on the slight character of the feeble gill rakers. By a comparison of a very large series of the alleged species from Professor Jordan's collection I have come to the conclusion that they are all forms of a single species. The gill rakers are usually rather more feeble than in the rest of the species of *Lepomis*, but this again is a question of degree. *Bryttus* has been distinguished from *Lepomis* by the presence of palatine teeth. This is also a character of degree, and is subject to the most perfect gradation. I have found it impossible to retain *Xystroplites* and *Eupomotis* also, as there is complete gradation in the character of the pharyngeals between *Lepomis* proper and *Xystroplites* and again between *Xystroplites* and *Eupomotis*, both as to the width and form of the bones themselves and the form of the teeth." (McKay, Proc. U. S. Nat. Mus., 1881, p. 88.) (*λεπίς*, scale; *πῶμα*, operculum, a character supposed to distinguish the genus from *Sparus*.)

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* Dr. Boulenger divides *Lepomis* and *Eupomotis* as here understood into genera, thus defined:

*a.* Supplemental maxillary absent or reduced to a slight rudiment; pectoral fin obtuse. **Lepomis.**

*aa.* Supplemental maxillary absent; pectoral fin acutely pointed. **Eupomotis.**

*a*. Pectoral fins short, obtuse, not reaching beyond front of anal, considerably shorter than head; dorsal spines low.

**LEPOMIS**:

*b*. Gill rakers shortish, but rather firm, x + 8 or 9; palatine teeth present.

*c*. Opercular flap in adult very long, but narrow; scales 43 to 48; longest dorsal spines about 3 in head; some bluish stripes on head; belly red in adult. AURITUS, 1396.

*cc*. Opercular flap short and broad; scales 36 to 40; longest dorsal spines about half head; sides with rows of red spots. MINIATUS, 1397.

**XENOTIS** (*ξενός*, strange; *οὖς*, ear):

*bb*. Gill rakers very soft and weak, x + 8 or 9; palatine teeth obsolete, so far as known.

*d*. Dorsal spines rather long, about half head; sides with rows of bronze spots; scales 34 to 41. GARMANI, 1398.

*dd*. Dorsal spines short, about 3 in head in adult; opercular spot in adult very long and broad, variously shorter in young; colors brilliant, excessively variable; scales 36 to 45. MEGALOTIS, 1399.

**HELIOPERCA** (*ἡλιος*, sun; *πέρχη*, perch):

*aa*. Pectoral fins more or less pointed, not much, if any, shorter than head, and reaching to or beyond front of anal; gill rakers rather long, slender, and firm, x + 11 to 13.

*e*. Scales very large, about 35 (33 to 39) in lateral line.

*f*. Opercular spot short, wholly surrounded by a red margin; mucous pores on head large; sides with conspicuous red spots; dorsal spines moderate, the longest not quite half head. HUMILIS, 1400.

*ff*. Opercular spot plain black; body without red spots, but with some bluish bands. HAPLOGNATHUS, 1401.

*ee*. Scales moderate or small; mucous pores small; dorsal spines high, the longest half head.

*g*. Dorsal fin without black at base of its last rays; opercular flap shortish; sides with chain-like cross bands. MACROCHIRUS, 1402.

*gg*. Dorsal and anal fins each with a large black blotch at base of posterior rays; opercular flap large, but not long; no red spots, the colors often brilliant but not varied. PALLIDUS, 1403.

### Subgenus LEPOMIS.

### 1396. LEPOMIS AURITUS (Linnæus).

(Yellow Belly; Redbreast Bream.)

Head (without flap) 2¾ to 3; depth 2 to 2½; eye 4 to 4½ in head. D. X, 11 or 12; A. III, 8 to 10; scales 6–43 to 48–15, 40 to 45 pores; 7 rows of scales on cheek; scales on breast very small. Body elongate, not much elevated. Snout moderately prominent. Mouth rather large, oblique, the maxillary reaching past front of eye. Palatine teeth few, rather large. Gill rakers quite short, x + 8 or 9, not much longer than in *Lepomis megalotis*, but stiff and rough, set wide apart, diminishing in size from the angle forward. Opercular flap very long (longer in the adult than on any other of the sunfishes except *Lepomis megalotis*), narrow, usually not wider than the eye; in the young the flap is variously shorter, but always narrow; lower margin of flap usually pale. Dorsal spines rather low, the longest 3 in head; pectoral 1⅓ to 1¼ in head. Color olive; belly largely orange red; scales on the sides with reddish spots on a bluish ground; vertical fins chiefly orange or yellowish; head usually with bluish stripes, especially in front of eye, most distinct in adult; fins becoming dusky in spirits; no dusky blotch on last rays of dorsal and anal. Length 8 inches. Maine to Louisiana; abundant in all streams east of the Alleghanies; the typical form above described chiefly northward. (*auritus*, eared.)

*Labrus auritus*, Linnæus, Syst. Nat., Ed. x, 1758, 283, Philadelphia.
*Bryttus unicolor*, Cuvier & Valenciennes, Hist. Nat. Poiss., vii, 464, 1831, Philadelphia and Charleston.
*Pomotus rubricauda*, Storer, Jour. Boston Soc. Nat. Hist., 1842, 177, Concord, New Hampshire. (Coll. E. S. Hoar.)
*Lepomis ophthalmicus*, Cope, Jour. Ac. Nat. Sci. Phila., 1868, 233, Roanoke River, Virginia.
*Lepomis auritus*, *elongatus* and *mystacalis*, Jordan & Gilbert, Synopsis, 475 and 477, 1883.
*Lepomis auritus*, Bollman, *l. c.*, 573; Boulenger, Cat., i, 24.

Represented southward, from Virginia to Louisiana by

### 1396a. LEPOMIS AURITUS SOLIS (Cuvier & Valenciennes).

Scales on cheeks larger, in 5 or 6 rows; scales on breast large. A dusky blotch on last rays of dorsal. Very abundant in coastwise streams. passing into the typical form northward. (*solis*, of the sun.)

*Pomotis solis*, Cuvier & Valenciennes, Hist. Nat. Poiss., vii, 468, 1831, Lake Pontchartrain, Louisiana; in part.
*Pomotis elongatus*, Holbrook, Jour. Ac. Nat. Sci. Phila., 1855, 47, pl. 5, fig. 1, St. Johns River, Florida.
*Lepomis mystacalis*,* Cope, Proc. Amer. Philos. Soc., 1877, 66, East Florida.

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**Lepomis mystacalis* (*Cope*): Head 3⅔; depth 2. Eye large, 3⅓ in head. D. X, 12; A. III, 12; scales 7–51–15. Body deep, compressed. Dorsal spines robust, little shorter than the soft rays; paired fins long; maxillary extending somewhat beyond front of orbit; 4 rows of scales on cheeks; opercular spot short, without border. Gill rakers slender. Dusky, sides silvery, with irregular, short, dark, vertical bars; a pale band from mouth across preopercle, a dark line below this, then a silvery band; lower parts and most of vertical fins yellow. East Florida.—*Cope*.

### 1397. LEPOMIS MINIATUS,* Jordan.

Head 2¾; depth 2¼; eye large, 3½ in head. D. X, 10; A. III, 9; scales 4–40–11, 4 rows on cheek. Body oblong and somewhat regularly elliptical. Mouth rather large. Opercular flap short and broad, entirely black or dark green. Gill rakers stout but not very short. Palatine teeth present. Dorsal spines rather long, as long as from tip of snout to posterior edge of pupil; pectorals long. Sides of male with about 14 rows of red spots, those of the lower rows very bright in life; middle of side with a few scales with black spots, and some black on scales under the pectorals; belly orange, with red spots. Length 6 inches. Mississippi Valley and southward in lowland streams; common about New Orleans, ranging from Texas eastward to Indian River. (*miniatus*, scarlet.)

*Lepomis miniatus*, Jordan, Bull. x, U. S. Nat. Mus., 26, 1877, Tangipahoa River, Louisiana; (Coll. T. H. Bean); Jordan & Gilbert, Synopsis, 476, 1883.

### Subgenus XENOTIS, Jordan.

### 1398. LEPOMIS GARMANI, Forbes.

Head 2⅘; depth 2¼. Eye large. D. X, 10 or 11; A. III, 8 to 10; scales 5–34 to 41–14, 5 rows on cheek. Body rather deep; mouth moderate; maxillary not reaching front of pupil; longest dorsal spine about half head. Gill rakers short and flexible. Dusky olive, sides with rows of bronze spots, 1 on each scale, 7 rows below lateral line; head with blue; opercular flap large, ⅔ diameter of eye. Length 4 inches. Perhaps not distinct from *Lepomis miniatus*. (Named for Professor Harrison Garman, now of the University of Kentucky, at Lexington.)

*Lepomis garmani*, Forbes, Bull. Ill. Lab. Nat. Hist., 135, January, 1885, Little Fox River, at Phillipstown, and Wabash River and Drew Pond, at Carmi, Illinois; (Coll. Forbes); Boulenger, Cat., i, 27.

### 1399. LEPOMIS MEGALOTIS (Rafinesque).

(Long-eared Sunfish.)

Head without flap, 3 in length; depth 1⅔ to 2½; eye 3½ to 4 in head. D. X, 10 to 12; A. III, 8 to 10; scales 5–36 to 45–14; pores 31 to 40, about 5 rows on cheek. Body short and deep, compressed, the back very strongly arched in adult, the profile very steep, usually forming an angle above eye, but sometimes full and convex. Mouth small, oblique, the premaxillary rather below the eye, the maxillary extending to opposite middle of eye. Gill rakers very short and soft, weaker than in any other species, x + 8 or 9. Dorsal spines very low, the longest little longer than the snout, 3 in head. Pectoral 1⅓ to 1½ in head. Opercular flap in the adult very long and broad, with a broad or narrow pale blue or red margin, the margin sometimes very broad, sometimes almost wanting; the flap half or more longer than the eye in the adult, much shorter in the young, its development subject to great variation. Color, brilliant blue and orange; the back chiefly blue; the belly entirely orange, the orange on the sides in spots, the blue in wavy, vertical streaks; lips blue; cheeks orange, with bright blue stripes; blue stripes before eye; iris red; soft parts of vertical fins with the rays blue and the membranes orange; ventrals dusky. Length 8 inches. Michigan to Minnesota, South Carolina, and southwest to the Rio Grande; very abundant in most streams, especially in clear brooks. One of our most brightly colored fishes. Extremely variable; the young are often elliptical in form, and the size at which the characteristic ear flap is developed varies greatly with different individuals. We have thus far failed to distinguish any tangible varieties. Some southern specimens have the ear flap longer (*fallax*); some northern ones have the scales rather larger (*inscriptus*), or the margin of the ear flap broader than usual (*peltastes*), or wanting altogether (*lythrochloris*); others (*aureolus*) are bright golden with the flap short; some southern specimens (*breviceps*) have a dusky spot on the last rays of dorsal; still others (*marginatus*) have the ear flap bordered with green. These characters gradually disappear on examination of a large series. (*μέγας*, great; *ὀὐς*, ear.)

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* This is probably a distinct species; not the young of *auritus*, as Bollman and Boulenger have regarded it.

*Ichthelis megalotis*, Rafinesque, Ichth. Oh., 29, 1820, Ohio River.

*Pomotis nitida*, Kirtland, Bost. Journ. Nat. Hist., 472, 1842, Ohio.

*Pomotis breviceps*, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1853, 309, Otter Creek, Arkansas. (Coll. Capt. Geo. B. McClellan.)

*Pomotis fallax*, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1854, 24, Elm Creek, Texas. (Coll. John H. Clark.)

*Pomotis convexifrons*, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1854, 24, Rio Cibolo, Texas. (Coll. Clark.)

*Pomotis nefastus*, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1854, 24, Rio Cibolo and Salado Creek, Texas. (Coll. Clark.)

*Pomotis sanguinolentus*, Agassiz, Amer. Jour. Sci. and Arts, 1854, 302, Huntsville, Alabama.

*Pomotis inscriptus*, Agassiz, Amer. Jour. Sci. and Arts, 1854, 302, Huntsville, Alabama.

*Pomotis bombifrons*,* Agassiz, Amer. Jour. Sci. and Arts, 1854, 303, Huntsville, Alabama.

*Pomotis marginatus*, Holbrook,† Jour. Ac. Nat. Sci. Phila., 1855, 49, St. Johns River, Florida.

*Pomotis popeii*, Girard, Pacific R. R. Survey, x, 26, 1858, headwaters of Colorado River, Texas. (Coll. Capt. Pope.)

*Lepomis peltastes*, Cope, Proc. Amer. Phil. Soc., 1870, 453, Huron River, Michigan. (Coll. Prof. A. Winchell.)

*Xenotis lythrochloris*, Jordan, Ann. N. Y. Lyc. Nat. Hist., 376, 1877, Wabash River.

*Xenotis aureolus*, Jordan, Ann. N. Y. Lyc. Nat. Hist., 376, 1877, Wabash River.

*Lepomis megalotis*, Jordan & Gilbert, Synopsis, 477, 1883; Boulenger, Cat., I, 26.

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* *Lepomis bombifrons* (Agassiz): Head 2¾; depth 2⅛. D. X, —; A. III, —; scales 5–?–11. Body rather short and deep, with the profile very steep and the back very much arched, the greatest depth of the body being over the opercles; opercular flap very small, unmargined. Eye large; a slight angle in front of the eye. Gill rakers unknown. Mouth moderate, placed very low; the premaxillaries entirely below the eye; maxillary extending back to the middle of the pupil. Dorsal spines moderate, the last ones somewhat shortened. Anal fin large, pectorals and ventrals reaching anal. Scales of cheek in 5 rows. Light brown; fins pale, unspotted. Scales of belly and sides dotted with golden orange. Length 4 inches. Tennessee River; this account taken from the original description and from a tracing of a drawing received from Richard Bliss.—*Agassiz.*

† *Lepomis marginatus* (Holbrook): Head 3; depth 2. D. IX or X, 12; A. III, 10. Body short and deep; snout shorter than diameter of eye; maxillary reaching orbit; paired fins rather long. Color dark olive with darker vertical bars; head and body with numerous bluish-green spots; opercular flap bordered with green. St. Johns River, Florida.—*Holbrook.*

### Subgenus HELIOPERCA, Jordan.

### 1400. LEPOMIS HUMILIS (Girard).

(RED-SPOTTED SUNFISH.)

Head 2¾ to 3; depth 2¼ to 2½; eye large, 3 to 3½ in head. D. X, 10 or 11; A. III, 8 or 9; scales 5–34 (33 to 39)–11; pores 25 to 32, about 5 rows on cheek. Body oblong. Scales large. Spines rather high. Profiles not very steep. Mucous pores on head very large; opercular flap rather long, broad, with a very broad red margin, which entirely surrounds the black. Longest dorsal spine not quite half head; pectoral a little shorter than head. Gill rakers rather long, blunt, x + 9 to 11, well developed. Bluish, with conspicuous greenish spots and mottlings posteriorly; sides with many conspicuous round, salmon-red spots, usually a faint black spot on last rays of dorsal; belly and lower fins red. Length 4 inches. Ohio and Kentucky to the Dakotas, Kansas, and Texas; locally abundant, especially in sandy streams of the Lower Missouri basin; a small, highly-colored species. (*humilis*, humble.)

*Bryttus humilis*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1857, 201, Sugar Loaf Creek, Arkansas.
*Bryttus oculatus*,* COPE, Jour. Ac. Nat. Sci. Phila., 1865, 83, Lake Whittlesey, Minnesota.
*Lepomis anagallinus*, COPE, Jour. Ac. Nat. Sci. Phila., 1868, 221, Leavenworth, Kansas.
*Lepomis humilis*, JORDAN & GILBERT, Synopsis, 479, 1883; EVERMANN & COX, Report U. S. Fish Comm., XV, III, 1893 (1895).
*Eupomotis humilis*, BOULENGER, Cat., I, 30.

### 1401. LEPOMIS HAPLOGNATHUS, Cope.

Head (without flap) 3¼; depth 2⅗; eye 3½ in head without flap, equal to the nearly flat interorbital space. D. X, 11; A. III, 9; scales 6–35–14 or 15, 6 rows on cheek. Form oval. Dorsal and ventral outlines subequally convex. Lower lip more prominent, maxillary bone reaching anterior line of orbit, lower pharyngeals narrow, with conical teeth; gill rakers obtuse, rather stout; no supplementary maxillary bone nor palatine teeth. Pectorals not described; ventrals barely reaching anal; extremities of soft dorsal and anal of the same length, and falling far short of base of caudal. Caudal notched at middle, the lobes beveled at the free borders. Opercular flap rather long. Color olivaceous, yellowish below, a blue band crossing the preorbital bone above, and another following the premaxillary border and passing along the inferior border of the orbit; below this another blue line crosses the cheek. Other blue bands have been obscured by the alcohol; flap plain black. Length of type 4½ inches. Monterey, Nuevo Leon. The most southern of the group to which it belongs, and, the first known from Mexican waters. (Cope.) (ἁπλοός, simple; γνάθος, jaw.)

*Lepomis haplognathus*, COPE, Proc. Amer. Philos. Soc., 1884 (1885), 168, Monterey, Nuevo Leon. (Coll. Cope.)

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* *Lepomis oculatus* (Cope): Similar to *Lepomis humilis*, but the body deeper, the caudal peduncle and fin forming but ⅓ of length. Head short; opercular flap long, with a black spot as large as eye, surrounded by a broad, pale margin; body without red spots. Depth 2⅓. Scales 5–32–11. Length 3 inches. Minnesota.—*Cope.*

### 1402. LEPOMIS MACROCHIRUS, Rafinesque.

Head 3; depth 2⅓; eye 3¾ to 4 in head. D. X, 12; A. III, 10; scales about 6-42-15, about 7 rows on cheek. Body rather elongate, the head somewhat acute. Pectoral fins pointed, as long as head, reaching beyond ventrals to anal. Gill rakers rather long and slender, strongly toothed, x + 11. Longest dorsal spine about half head. Supplemental bone minute. Bright steel blue, with many bronze orange spots, which cover nearly the whole surface, so arranged that the ground color forms a series of vertical chain-like bars, very conspicuous in life; vertical fins mottled with bronze and usually more or less edged with pale orange; sometimes a faint black dorsal spot; no distinct blue stripes on cheek, but the sides of the head shaded with purplish. Opercular flap small, black, margined with pale. Length 5 inches. Ohio Valley and southwestward to Arkansas and Kentucky; rare; a small, handsome species. (*μακρός*, large; *χεῖρ*, hand.)

*Lepomis macrochira*, Rafinesque, Journ. de Physique, 420, 1819, Ohio River; Licking River; Jordan & Gilbert, Synopsis, 475, 1883; Bollman, *l. c.*, 572.

*Lepomotis nephelus*, Cope, Journ. Amer. Philos. Soc., 1868, 222, Kiskiminitas River, western Pennsylvania.

*Eupomotis macrochirus*, Boulenger, Cat., I, 30.

### 1403. LEPOMIS PALLIDUS (Mitchill).

(Blue-gill; Blue Bream; Blue Sunfish; Copper-nosed Bream; Dollardee.)

Head 3 (2¾ to 3¼); depth 2 (1⅘ to 2¼); eye 3½ to 4 in head. D. X, 11 or 12; A. III, 10 to 12; scales 7-43 to 52-16, 40 to 50 pores, 5 rows of scales on cheek. Body comparatively short and deep, compressed; the young slender, the adult nearly orbicular. Caudal peduncle rather slender. Head not large, the projecting snout usually forming an angle above eye. Mouth quite small, oblique, the jaws about equal, the maxillary barely reaching the front of the eye. Opercular flap very short in the young; in the adult rather long and wide, without pale edge. Gill rakers moderately long, nearly terete, bent slightly downward, about x + 11 to 13. Dorsal spines strong and high, the longest about half head, usually longer than snout and eye; ventral fins reaching anal; pectorals very long, usually longer than head, reaching past base of anal spines. Olive green; adults dark; young more or less silvery, with a purple luster in life; sides with undulating, often chain-like, transverse greenish bars, which become obsolete in the adult; no blue stripes on cheeks; a diffuse black blotch at base of posterior rays of dorsal and anal, often obscure in young; no red on fins; very old specimens often with the belly coppery red. Length 12 inches. Great Lakes to Florida and the Rio Grande; very abundant; one of our most widely distributed and variable species; found in all quiet streams throughout its range, and often brought into the markets; a good pan-fish. (*pallidus*, pale.)

*Labrus pallidus*, Mitchill, Trans. Lit. & Phil. Soc., N. Y., 1815, 407, New York; misprinted *palladus*.

*Lepomis appendix*, Mitchill, Amer. Month. Mag., 1818, 247, New York.

*Pomotis incisor*, Cuvier & Valenciennes, Hist. Nat. Poiss., VII, 466, 1831, New Orleans.

*Pomotis gibbosus*, Cuvier & Valenciennes, Hist. Nat. Poiss., VII, 467, 1831, Charleston.

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*Pomotis speciosus*, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 24, Brownsville, Texas.
*Pomotis obscurus*, AGASSIZ, Amer. Jour. Sci. and Arts, 1854, 302, Huntsville, Alabama (specimens deeply colored, almost black.)
*Pomotis luna*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1857, 201, Fort Snelling, Minnesota.
*Lepomis longispinis*, COPE, Proc. Ac. Nat. Sci. Phila., 1865, 83, Leavenworth, Kansas.
*Lepomis ardesiacus*, COPE, Journ. Ac. Nat. Sci. Phila., 1868, 222, Kiskiminitas River, Pennsylvania.
*Lepomis purpurescens*, COPE, Proc. Amer. Philos. Soc., 1870, 454, Yadkin River, North Carolina.
*Lepomis pallidus*, GILL & JORDAN, Field and Forest, 1877, 190; JORDAN & GILBERT, Synopsis, 479, 1883, and of most recent writers.
*Eupomotis paliidus*, BOULENGER, Cat., I, 29.

## 460. EUPOMOTIS, Gill & Jordan.

*Pomotis*, HOLBROOK, Icth. S. Carolina, I, 6, 1860, (not of RAFINESQUE).
*Eupomotis*, GILL & JORDAN, Field and Forest, 1877, 190, (*aureus*).
*Xystroplites*, JORDAN MS. in COPE, Proc. Amer. Philos. Soc., XVII, 67, 1878, (*gillii*).

This genus, as understood by us, is very closely related to *Lepomis*, differing only in the blunter and more pavement-like teeth of the lower pharyngeal bones. These bones are, in typical species, broad and concave, especially in the adult. There is considerable variation among the species, and it is possible that this division can not be maintained. Most of the species have long pectoral fins, the supplemental maxillary lost or very much reduced, and the opercular flap always with an orange patch on its lower posterior portion. Gill rakers various, usually short. The retention of this genus is possibly justified by convenience, but neither the longer pectorals nor the blunt pharyngeals separate it sharply from *Lepomis*, with which it has been united by McKay, Bollman, and Jordan & Gilbert. (*εὖ*, well; *πῶμά*, opercle; *οὖς*, ear; or rather, *εὖ*, genuine *Pomotis*, sunfish.)

XYSTROPLITES (*ὀύστρον*, scraper; *ὁπλίτης*, armature, from the gill rakers of the typical species):
*a.* Pectorals shorter than head, not extending beyond tips of ventrals; scales small, about 42; gill rakers rather long; coloration plain. PALLIDUS, 1404.
EUPOMOTIS:
*aa.* Pectorals longer than head, extending to beyond front of anal; gill rakers moderate or short; opercular flap orange on its lower posterior portion.
  *b.* Cheeks without marked blue or orange spots or lines.
    *c.* Scales large, 34 to 39; opercular flap smaller than eye, its margin blood-red in male. HEROS, 1405.
    *cc.* Scales moderate, 42 to 44; opercular flap broad, with a very broad orange or whitish margin.
      *d.* Cheeks with 5 rows of scales; color chiefly greenish. HOLBROOKI, 1406.
      *dd.* Cheeks with 6 or 7 rows of scales. EURYORUS, 1407.
  *bb.* Cheeks with wavy blue lines; sides of body profusely spotted with orange; scales about 47; dorsal spines not very low; opercular flap large, its lower posterior border always scarlet. GIBBOSUS, 1408.

### Subgenus XYSTROPLITES, Jordan.

### 1404. EUPOMOTIS PALLIDUS,* (Agassiz).

Head 2¾; depth 2⅖; eye 4½; snout 3½; scales 8–42–12, 5 rows on cheek. D. X, 10; A. III, 9. Body elongate, rather deep mesially. Caudal peduncle rather elongate. Snout projecting, forming an angle above eye. Mouth wide, the lower jaw projecting; maxillary reaching just past front of pupil. Eye as long as opercular flap; flap moderate, broad, with a very wide pale edge below and behind. Dorsal spines moderate, as long as snout and half of orbit; pectoral short, reaching tips of ventrals. Lower pharyngeal teeth blunt, almost paved. Light olive, uniform in spirits; traces of dusky mottlings on last rays of dorsal and anal. Length 7 inches. Georgia to Texas; not common, but few specimens known. (*pallidus*, pale.)

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* "This species resembles *Pomotis incisor* (*Lepomis pallidus*) in the outline of the body, the nature and coloration of the scales, and in the size and form of the fins, but it differs greatly from it by its large mouth, the free extremity of the upper jaws reaching the vertical line of the middle of the eye, by the presence of teeth upon the palate, and by the ventral fins being placed immediately under the pectorals. The black opercular appendage, which is very short, has a narrow

*Pomotis pallidus*, AGASSIZ, Amer. Jour. Sci. Arts, 1854, 303 (name preoccupied in *Lepomis* by *Labrus pallidus*, MITCHILL, but not in *Eupomotis*.

*Bryttus albulus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1857, 200, Rio Blanco, Texas; (Type, 421).

*Xystroplites gillii*, JORDAN, Bull. x, U. S. Nat. Mus., 24, 1877, "Garden Key, Florida" (undoubtedly an error, as there is no fresh water stream or pond on the island of Garden Key).

*Lepomis albulus*, JORDAN & GILBERT, Synopsis, 481, 1883; BOLLMAN, *l. c.*, 575.

*Lepomis lirus*, MCKAY, Proc. U. S. Nat. Mus., 1881, 89, (after *Pomotis pallidus*, Agassiz).

## Subgenus EUPOMOTIS.

### 1405. EUPOMOTIS HEROS (Baird & Girard).

Head 2⅘ to 3; depth 2 to 2⅖; eye 3½ to 4⅓; snout 3½ to 4. D. X, 11; A. III, 11; scales 4–34 to 39–13, 4 rows on cheek. Appearance of *Lepomis pallidus*. Body robust, moderately elongate, dorsal and ventral outlines about equally curved; head rather large, the projecting snout forming a considerable angle above the eye. Mouth rather wide, oblique, the maxillary reaching slightly past front of eye. Longest dorsal reaching past posterior border of pupil; pectorals reaching beyond middle of anal; ventral spine 1¼ to 1⅓ in distance between origin of ventrals and anus. Opercular flap smaller than eye, smaller than in *E. holbrooki*, much as in *E. gibbosus*. Gill rakers short and not very stiff. Pharyngeal teeth paved; the pharyngeal teeth not so blunt as in *E. holbrooki* or in *E. gibbosus*. Life colors dark greenish above, gradually becoming brassy toward the belly, which is light brassy; opercular spot greenish black, the flap with a broad, blood-red border in the male, plain in the female; no spot on dorsal or anal fin. Southern Indiana to Florida and the Rio Grande basin, in lowland streams; rather rare. (ἥρως, hero; *Heros* is the name of a genus of *Cichlidæ*, which these fishes resemble.)

*Pomotis heros*, BAIRD & GIRARD,* Proc. Ac. Nat. Sci. Phila., March, 1854, 25. Rio Cibolo, Texas.

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orange border behind; there is a black spot at the base of the posterior rays of the dorsal; both dorsal and anal are marked by 1 or 2 dark stripes; the caudal is crossed by several dotted vertical lines; there are 8 or 9 dusky bars across the sides between the head and tail. This species bears the same relation to *Pomotis* that *Pomoxis* bears to the true *Centrarchus* in the size of the mouth and form of the body, and I have no doubt it will some day become the type of a distinct genus." (Agassiz.) Tennessee River, at Huntsville, Alabama. We are informed by Mr. Richard Bliss that the types of this species have the pharyngeals paved. Since these pages have been put in type we have received from Mr. Samuel Garman a description of Agassiz's type which leaves little doubt of its identity with the present species. It has: Head 2¾; depth 2⅓. D. X, 10; A. III, 10. Scales 5-36–13. Pectoral shorter than head barely reaching front of anal; mouth large, with projecting snout, the maxillary nearly reaching middle of pupil; last rays of dorsal and anal dusky above base.

*Pomotis notatus*,[*] AGASSIZ, Amer. Journ. Sci. and Arts, March, 1854, 302, Huntsville, Alabama.

*Lepomis notatus*, JORDAN & GILBERT, Synopsis, 482, 1883.

*Lepomis heros*, JORDAN & GILBERT, Synopsis, 480, 1883; BOLLMAN, *l. c.*, 575.

*Eupomotis heros*, BOULENGER, Cat., I, 32.

### 1406. EUPOMOTIS HOLBROOKI (Cuvier & Valenciennes).

Head 3 to 3½; depth 2 to 2¼; eye 4 in head, as long as snout. D. X, 10 to 12; A. III, 9 to 11; scales 6–44 or 45–15, 43 pores, 5 rows on cheek. Body robust, elevated, the snout rather produced; maxillary reaching front of orbit; preopercle slightly denticulate. Dorsal fin high, the spines about as high as the soft rays, the longest half head; pectoral fins very long, long as head. Gill rakers moderate, obtuse, strongly toothed, x + 10. Opercular flap short, broad, with a broad orange margin below and behind. No palatine teeth; lower pharyngeals broad; the teeth large, with subspherical crowns. Dusky olive, silvery below; throat yellow; fins dark, with yellowish rays; no black dorsal spot. Length 10 inches. Virginia to Florida; abundant in lowland streams. (Named for Dr. John Edwards Holbrook, of Charleston, author of the excellent Ichthyology of South Carolina.)

*Pomotis holbrooki*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., VII, 466, 1831, Charleston, South Carolina.

*Pomotis speciosus*, HOLBROOK, Jour. Ac. Nat. Sci. Phila., 1855, 48, pl. 5, fig. 2, St. Johns River, Florida.

*Pomotis microlophus*, GÜNTHER, Cat., I, 264, 1859, St. Johns River, Florida; after Holbrook.

*Xystroplites longimanus*,[†] COPE, Proc. Amer. Philos. Soc., 1877, 66, Volusia and Bay Port, Florida.

*Lepomis holbrookii*, JORDAN & GILBERT, Synopsis, 482, 1883; BOLLMAN, *l. c.*, 576.

*Eupomotis holbrookii*, BOULENGER, Cat., I, 31.

### 1407. EUPOMOTIS EURYORUS (McKay).

Head 3¾; depth 2⅖. D. X, 11; A. III, 10; scales 6–43–14, 6 or 7 rows on cheek. Body very robust, compressed; form nearly oval; dorsal outline more convex than ventral; profile steep, convex. Mouth oblique, small; maxillary reaching front of eye. Outer teeth stronger than others; teeth on front of palatines. Lower pharyngeals with the rather long posterior spur turned up, stoutish; the inner angle rounded, somewhat obtuse.

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[*] We do not know which of these two names, *heros* and *notatus*, has priority. We give preference to *heros* as a less conventional name and as already most widely accepted.

[†] *Xystroplites longimanus*, Cope, is thus described: "Body elevated, but the head rather produced, so that the profile is oblique and nearly straight from the base of the dorsal fin. The depth of the body enters the total length 2.5 times, and the length of the head enters the same 3.6 times. The orbit is large, equaling the length of the muzzle, and entering the length of the head 4 times. The interorbital space is 1.5 times the diameter of the orbit. The muzzle is subconic and the end of the maxillary bone reaches the line of the anterior margin of the orbit. The dorsal fin is elevated, the spines equaling the soft rays and not separated from them by a notch. Caudal fin openly notched; ventral not reaching anal; the pectoral very long, reaching the line of the fifth anal soft ray. Formula: D. X–12; A. III–11; P. 13. Scale formula: 7–44–15; 5 rows on the preoperculum below the orbit. The color above is dusky, below silvery, the gular and thoracic region light yellow. The opercular black spot is short and has a crimson border. Fins black, the caudal, anal, and pectoral fins with yellow rays. The ends of the long gill rakers are obtuse, as in *L. apiatus*. There are no palatine teeth. Length 170 meters. Volusia and Bay Port, Florida."—*Cope*.

Teeth stout, very much blunted, not close set, the inner considerably stronger and less blunt than the rest. Gill rakers short, stout, about 8 in number, the inner surface roughened. Maxillary with a small but perfectly distinct supplemental bone. Eye very small, considerably less than length of snout. Opercular flap nearly as long as snout, surrounded by a very broad, paler, membranous margin; scales on the opercle large, in 5 rows. Dorsal spines low, the longest as long as from snout to eye; much lower than soft rays; caudal peduncle and fin short and broad; ventrals and pectorals short, reaching vent. Scales on breast larger than those on cheeks. Color in spirits mottled olive, yellowish below; top of head blackish; membranes of vertical fins dusky; ventrals dusky, with lighter margins; pectorals pale. Length 8 inches. Upper Great Lake region, long known from one specimen; several others lately obtained in northern Ohio and northeastern Indiana show that the species is a valid one, although allied to *Eupomotis gibbosus.* (*εὐρύς*, wide; *ὅρος*, margin.)

*Lepomis euryorus*, McKay, Proc. U. S. Nat. Mus., 1881, 89, Lake Huron at Fort Gratiot, Michigan; (Type, No. 4109); Jordan & Gilbert, Synopsis, 481, 1883; McCormick, Fishes Lorain Co., Ohio, 27, 1892; Kirsch, Bull. U. S. Fish Comm., xiv, 1894, 38.

*Lepomis auritus*, Boulenger, Cat., i, 24; in part.

### 1408. EUPOMOTIS GIBBOSUS (Linnæus).

(Common Sunfish; Bream; Pumpkin Seed; Sunny.)

Head 3 to 3¼; depth 1¾ to 2; eye 4 to 4½ in head; snout 4½. D. X, 10 to 12; A. III, 10 or 11; scales 6–40 to 47, pores 35 to 45, 4 rows on cheek. Body short and deep, compressed, the profile steep, convex, usually an angle above the eye. Head rather small. Mouth small, oblique, the maxillary scarcely reaching the front of the eye. Dorsal spines rather high, the longest 2 to 2½ in head, as long as eye and snout; the soft rays higher; pectorals long, as long as head. Scales large. Gill rakers short and soft, smaller than in any other species except *Lepomis megalotis*, x + 8 to 10. Pharyngeal teeth all bluntly rounded, paved, the bones very broad, somewhat concave. Color greenish olive above, shaded with bluish, the sides spotted and blotched with orange; belly orange yellow; cheeks orange, with blue wavy streaks; lower fins orange, upper bluish and orange spotted. Opercular flap rather small, the lower posterior part always bright scarlet, a mark which distinguishes this species, when adult, at once from all our other high-colored sunfishes. Length 8 inches. Great Lake region to Maine and southward east of the Alleghanies to Florida; rather rare in the Carolinas and Florida; found only in the northern parts of the Mississippi Valley—Iowa, Minnesota, Wisconsin, etc.; one of our most abundant fishes northward; a familiar and active inhabitant of clear brooks and ponds, defending its nests with great spirit. "A very beautiful and compact fish, perfect in all its parts, looking like a brilliant coin fresh from the mint." (*gibbosus* formed like the full moon.)

*Perca gibbosa*, Linnæus, Syst. Nat., Ed. x, 1758, 292, Carolina; after *Perca fluviatilis gibbosa, ventre lutea*, of Catesby.

*Sparus aureus*, WALBAUM, Artedi, Pisc., 290, 1792, lakes of New York; after "Goldfisch" of SCHÖPF.

*Morone maculata*, MITCHILL, Fishes of New York, 18, 1814, near New York City.

*Pomotis vulgaris*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., III, 91, 1829, Lake Huron, New York, Virginia, and Carolina.

*Pomotis ravenelii*, CUVIER & VALENCIENNES, *l. c.*, VII, 465, 1831, Philadelphia.

*Pomotis catesbei*, CUVIER & VALENCIENNES, *l. c.*, VII, 469, 1831, Philadelphia.

*Eupomotis aureus*,* BOULENGER, Cat., I, 32.

## 461. MICROPTERUS, Lacépède.

### (BLACK BASS.)

*Micropterus*, LACÉPÈDE, Hist. Nat. Poiss., IV, 325, 1802, (*dolomieu*).

*Calliurus*, RAFINESQUE, Journ. de Physique, 420, 1810, (*punctulatus* = *dolomieu*).

*Aplites*, RAFINESQUE, Ichth. Ohiensis, 30, 1820, (*pallidus* = *salmoides*).

*Lepomis*, RAFINESQUE, Ichth. Ohiensis, 30, 1820, (not *Lepomis*, RAFINESQUE, 1819), (*pallida* = *salmoides*).

*Nemocampsis*, RAFINESQUE, Ichth. Ohiensis, 31, 1820, (*flexuolaris* = *dolomieu*).

*Dioplites*, RAFINESQUE, Ichth. Ohiensis, 32, 1820, (*salmonea* = *dolomieu*).

*Aplesion*, RAFINESQUE, Ichth. Ohiensis, 36, 1820, (*calliura*).

*Huro*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., II, 126, 1828, (*nigricans* = *salmoides*).

*Grystes*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., III, 54, 1829, (*salmoides*).

Body oblong, compressed, the back not much elevated. Head oblong, conic. Mouth very large, oblique, the broad maxillary reaching nearly to or beyond the posterior margin of the eye, its supplemental bone well developed. Lower jaw prominent. Teeth on jaws, vomer, and palatines in broad villiform bands, the inner depressible; usually no teeth on the tongue. Preopercle entire; operculum ending in two flat points without cartilaginous flap. Branchiostegals normally 6. Gill rakers long and slender. Scales rather small, weakly ctenoid. Lateral line complete, the tubes straight, occupying the anterior half of each scale. Dorsal fin divided by a deep notch, the spines low and rather feeble, 10 in number; anal spines 3; the anal fin much smaller than the dorsal; pectorals obtusely pointed, the upper rays longest; ventrals close together below the pectorals; caudal fin emarginate. Posterior processes of the premaxillaries not extending to the frontals; frontals posteriorly with a transverse ridge connecting the parietal and supraoccipital crests, which are very strong. Vertebræ 16 + 16 or 17 = 32 or 33. Size large. Two species, among the most important of American "game fishes," now largely introduced into the waters of Europe. (μικρός, small; πτερόν, fin; the dorsal fin in the typical specimen having been injured, its posterior rays detached and bitten off short, were taken by Lacépède for a separate fin.)

*a.* Mouth moderate, the maxillary in the adult not extending beyond eye; scales small, about 11-74-17, about 17 rows on the cheek; young more or less barred or spotted, never with a black lateral band. DOLOMIEU, 1409.

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* Dr. Boulenger rejects the name *gibbosus* applied to this species, as it occurs in the tenth edition of the Systema Naturæ, not reappearing in the twelfth, with which he begins the binomial nomenclature. We have followed the custom of American authors in recognizing the tenth edition (of 1758) as the starting point of binomial nomenclature.

*aa.* Mouth very large, the maxillary in the adult extending beyond the eye; scales rather large, about 7-68-16, about 10 rows on the cheek; last spines of dorsal very short, so that the fin is almost divided into 2; young with a blackish lateral band.
SALMOIDES, 1410.

### 1409. MICROPTERUS DOLOMIEU, Lacépède.

(SMALL-MOUTHED BLACK BASS.)

Head 2½ to 3½; depth 3⅓ (2¾ to 3½); eye 1½ to 2 in snout, 5 to 6½ in head. D. X, 13 to 15; A. III, 10 to 12; scales 11–72 to 85–25, pores 67 to 78. Body ovate-fusiform, becoming deeper with age. Mouth large, but smaller than in *Micropterus salmoides*, the maxillary ending considerably in front of the hinder margin of the orbit, except in very old examples. Scales on the cheek minute, in about 17 rows; scales on the trunk comparatively small. Gill rakers long, x + 6 or 7 besides rudiments. Dorsal fin deeply notched, but less so than in *M. salmoides*, the ninth spine being about half as long as the fifth and not much shorter than the tenth. Fifth dorsal spine about 3⅕ in head; base of soft dorsal and anal scaly. Coloration dull golden green, with bronze luster, young with darker spots along the sides, which tend to form short vertical bars, but never a dark lateral band; 3 bronze bands radiating from eye across cheeks and opercles; a dusky spot on point of operculum; belly white; caudal fin yellowish at base, then black, with white tips; dorsal with bronze spots, its edge dusky. In some waters the fin-markings are obsolete, but usually they are very conspicuous in the young. Southern specimens usually have the scales of the lower part of the sides with faint dark streaks; adult specimens have all these marks more or less wholly obliterated, and become ultimately of a uniform dead green, without silvery luster. "The black bass is eminently an American fish; he has the faculty of asserting himself and of making himself completely at home wherever placed. He is plucky, game, brave, unyielding to the last, when hooked. He has the arrowy rush and vigor of a trout, the untiring strength and bold leap of a salmon, while he has a system of fighting tactics peculiarly his own. I consider him inch for inch and pound for pound the gamest fish that swims." (J. A. Henshall.) From Lake Champlain to Manitoba and southward on both sides of the mountains from James River to South Carolina and Arkansas; abundant; frequenting running streams, and preferring clear and cool waters; its southern limit is bounded by the presence of such waters. As a game fish this species is usually more highly valued than its congener. (Named for M. Dolomieu, a mineralogist in Paris for whom the mineral Dolomite was also named.)

*Micropterus dolomieu*, LACÉPÈDE, Hist. Nat. Poiss., IV, 325, 1802, locality uncertain, perhaps South Carolina; JORDAN & GILBERT, Synopsis, 485, 1883.

*Bodianus achigan*, RAFINESQUE, Amer. Month. Mag., 1817, 120, New York; Canada.

*Calliurus punctulatus*, RAFINESQUE, Ichth. Ohiensis, 26, 1820, Falls of the Ohio.

*Lepomis trifasciata*, RAFINESQUE, Ichth. Ohiensis, 31, 1820, Ohio River, etc.

*Lepomis flexuolaris*, RAFINESQUE, Ichth. Ohiensis, 31, 1820, Ohio River.

*Lepomis salmonea*, RAFINESQUE, Ichth. Ohiensis, 32, 1820, Kentucky, Green, Licking, and Ohio rivers.

*Lepomis notata*, RAFINESQUE, Ichth. Ohiensis, 32, 1820, Ohio River.

*Etheostoma calliura*, RAFINESQUE, Ichth. Ohiensis, 36, 1820, Ohio River; Salt River, Kentucky.

*Cichla fasciata*, Le Sueur, Journ. Ac. Nat. Sci. Phila., 1822, 216, Lake Erie.
*Cichla ohioensis*, Le Sueur, Journ. Ac. Nat. Sci. Phila., 1822, 218, Ohio River.
*Cichla minima*, Le Sueur, Journ. Ac. Nat. Sci. Phila., 1822, 220, Lake Erie.
*Centrarchus obscurus*, De Kay, N. Y. Fauna: Fishes, 30, pl. 17, fig. 48, 1842, Onondaga Creek, New York.
*Dioplites variabilis*, Vaillant & Bocourt, Miss. Sci. Mex., 1874, 142, Wabash River, New Harmony, Indiana; after Le Sueur MS., 1822.
*Centrarchus fasciatus* and *obscurus*, Günther, Cat., I, 258, 1859.
*Micropterus dolomiei*, Boulenger, Cat., I, 15.

### 1410. MICROPTERUS SALMOIDES (Lacépède).

(Large-mouthed Black Bass; Oswego Bass; Green Bass; Bayou Bass.)

Head 3 to 3½; depth 3 to 3½; eye 1½ to 2 in snout, 5 to 6 in head. D. X, 12 or 13; A. III, 10 or 11; scales 7–65 to 70–18, pores 58 to 67. Body ovate-fusiform, becoming deeper with age, moderately compressed. Head large. Mouth very wide, the maxillary in the adult reaching beyond the eye, in the young shorter. Scales on the cheek in about 10 rows; scales on the trunk comparatively large; tip of maxillary in adult as broad as eye. Lingual teeth sometimes present. Gill rakers longer than gill fringes, x + 7 or 8, besides rudiments. Dorsal fin very deeply notched, its fifth spine 3½ in head. Coloration dark green above; sides and below greenish silvery; young with a blackish stripe along the sides from opercle to the middle of the caudal fin; three dark oblique stripes across the cheeks and opercles; below and above the lateral band some dark spots; caudal fin pale at base, then blackish, whitish at tip; belly white. As the fish grows older the black lateral band breaks up and grows fainter, and the color becomes more and more of a uniform pale dull green, the back being darker; a dark opercular blotch usually present. Length 18 inches or more. Rivers of the United States from the Great Lakes and Red River of the North to Florida, Texas, and Mexico; everywhere abundant, preferring lakes, bayous, and sluggish waters. It grows to a larger size than the preceding species and is readily distinguished by its coloration and the larger mouth and larger scales. Both species vary much with different waters, but in general this species is less active than the preceding, and is less esteemed as a game fish. (*Salmo*, trout; εἶδος, like; the fish being often called "Trout" in the Southern States, being trout-like in gameness and in quality as food.)

*Labrus salmoides*, Lacépède, Hist. Nat. Poiss., 716, 1802, South Carolina. (Coll. Bosc.)
*Lepomis pallida*, Rafinesque, Ichth. Ohiensis, 30, 1820, Ohio, Miami, and Hocking rivers.
*Cichla floridana*, Le Sueur, Journ. Ac. Nat. Sci. Phila., 1822, 219, East Florida.
*Huro nigricans*, Cuvier & Valenciennes, Hist. Nat. Poiss., II, 124, 1828, Lake Huron; Günther, Cat., I, 255, 1859.
*Grystes nobilis*, Agassiz, Amer. Journ. Sci. and Arts, 1854, 298, Huntsville, Alabama. (Coll. Newman.)
*Grystes nuecensis*, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1854, 25, Rio Frio and Rio Nueces, Texas. (Coll. Clark.)
*Grystes megastoma*, Garlick, Treat. Art. Prop. Fish., 108, 1857, bays of Lake Erie.
*Dioplites nuecensis treculii*, Vaillant & Bocourt, Miss. Sci. Mex., 1874, 142, San Antonio de Bexar, Texas (Coll. Trécul.)
*Micropterus salmoides*, Jordan & Gilbert, Synopsis, 484, 1883; Boulenger, Cat., I, 16.

## Family CXLII. KUHLIIDÆ.

Body oblong, strongly compressed; scales large, ciliated. Lateral line complete, the tubes straight and occupying the anterior half of the exposed surface of the scale. Mouth large, protractile; maxillary exposed, without supplemental bone; teeth in jaws in villiform bands; teeth on vomer, palatines, entopterygoids, and ectopterygoids; tongue smooth; head partly naked; preorbital and preopercle denticulate; opercle with 2 spines. Gill membranes separate; 6 branchiostegals; pseudobranchiæ large; gill rakers long and slender. Dorsal fins connected at the base, with X, 9 to 13 rays, the spinous portion longer than the soft. Anal as much developed as the soft dorsal, with III, 10 to 12 rays. Dorsal and anal fins fitting in a well-developed sheath. Caudal emarginate. Pectorals obtusely pointed, with 14 or 15 rays, upper the longest. Ventrals behind base of pectorals, close together, with a strong spine. Posterior processes of the premaxillaries not extending to the frontals; supraoccipital bone extending forward to between the post-frontal processes, its crest not extending on the upper surface of the cranium; parietals short, without crest. Precaudal vertebræ with transverse processes behind the fourth; ribs all but the last 2 to 4 sessile, inserted on the centrum behind the transverse processes. (Boulenger.) Vertebræ 25 (10 or 11 + 14 or 15). One genus with 7 or 8 species inhabiting the Pacific Ocean, especially fresh and brackish waters of East Africa, the islands of the Indian and Pacific oceans, and north Australia; our species strictly marine. The relations of this family have been much in doubt. Its species were originally placed in the genus *Dules*, which is a near ally of *Centropristes* and *Serranus*. Dr. Gill recognized the superficial resemblance of these species to *Xenichthys*, which is one of the Sparoid forms. But in *Kuhlia* the preorbital is narrow, serrated, and not sheathing the maxillary; there is no axillary ventral scale and the opercle has 2 strong spines. All this indicates Serranoid affinities, for which reason we have hitherto placed *Kuhlia* near *Morone*. A similar thought seems to have been with Dr. Gill when he proposed the name *Moronopsis* for species of *Kuhlia*. Very lately Dr. Boulenger has shown in *Kuhlia* the presence of skeletal characters of the *Centrarchidæ*, and in his catalogue *Kuhlia* is placed in the latter family, but there are important differences and the natural character of the group *Centrarchidæ* disappears if this genus is introduced. We therefore admit *Kuhliidæ* as a distinct family between *Micropterus* and *Morone* and closely allied to both.

### 462. KUHLIA, Gill.

*Kuhlia*, Gill, Proc. Ac. Nat. Sci. Phila., 1861, 48, (*ciliatus*).
*Moronopsis*, Gill, Proc. Ac. Nat. Sci. Phila., 1863, 82, (*marginatus*).
*Paradules*, Bleeker, Nederl. Tijdschr. v. Dierkunde, 1, 257, 1872, (*marginatus* = *ciliatus*).

Body oblong, much compressed; head compressed; mouth short, oblique; maxillary without supplemental bone; lower jaw projecting; no canines; the teeth subequal; preorbital sharply serrate; angle of preopercle without strong spine. Gill rakers slender. Pseudobranchiæ large. Scales large, not very rough; lateral line distinctly arched in front; top of head naked. Dorsal fin deeply notched, but not divided to base, with 10 slender spines; caudal lunate; anal spines graduated, the fin short. Coloration bright silvery. (Named for Kuhl, a naturalist, associate of Van Hasselt, and the discoverer of the typical species in the streams of Java.)

*a.* Eye moderate, 3⅖ in head; pectorals 1⅖ in head; caudal with 2 oblique black bars on each lobe; dorsal with a dark bar. ARGE, 1411.

*aa.* Eye very large 2⅗ in head; pectorals 2⅓ in head; fins not barred. XENURA, 1412.

### 1411. KUHLIA ARGE, Jordan & Bollman.

Head 3½ to 3¾; depth 2⅔; eye 3⅖ in head. D. IX–I, 11; A. III, 11; scales 7–50 to 52–12. Body oblong, strongly compressed; back elevated above pectorals, the anterior profile straight and rather deep; caudal peduncle long, compressed. Mouth rather small, very oblique, the lower jaw considerably projecting; maxillary reaching anterior margin of pupil, 2⅔ to 2¾ in head. Eye moderate, slightly longer than snout. Teeth very small, in narrow bands, those on vomer in a V-shaped patch. Preorbital very narrow, its edge anteriorly with strong retrorse serræ, the moderately broad maxillary not sheathed by it. Least width of preorbital 3½ in eye. Serræ of preopercle sharp and fine, well developed below angle. Gill rakers long and slender, about 9 + 21. Scales rather small, ctenoid, firm, 3 or 4 rows on cheeks, 2 rows on interopercle; jaws, snout, and top of head naked; opercle with 2 strong spines, the lower the larger and nearly as long as pupil. Lateral line anteriorly rather sharply curved upward, concurrent with the back; no accessory ventral scale. Nostrils very small, round, close together. Dorsal spines high and pungent, hardly flexible, the first half as long as the second, the fifth longest, 1⅔ in head, reaching tip of eighth when depressed; dorsal fins very slightly connected by membrane; soft dorsal 1⅔ in anal, first ray 2 in head; caudal deeply forked, as long as head, its inner rays not quite half as long as outer; first anal spine 1⅗ in second, which is strongest and equal in length to third; free margin of anal slightly concave, first soft ray 2¾ in head; pectorals short, pointed, 1⅖ to 1½ in head; ventrals moderate, reaching vent, 1⅗ in head; soft dorsal and anal free from scales; a scaly sheath along base of both dorsals. Coloration bluish above, sides brilliant silvery; soft dorsal with a black oblique bar across its anterior rays; caudal with 2 black and 3 white cross bands on each lobe, these convergent backward; lower fins pale; axil of pectoral dusky on the inner side. Length 1 foot. Galapagos and Revillagigedos archipelagos; locally common. This species was first known from several specimens taken by the *Albatross* at Chatham Island. It has since been taken in great abundance by Dr. Gilbert about Clarion Island. It is very close to *Kuhlia tæniura*, of the waters of Java, Sumatra, and Buro, with which it is identified by Dr. Boulenger. *Kuhlia tæniura* has the eye larger, 2⅔ to 3 in head. Comparing our specimens with the full description of the latter species given by Dr. Bleeker, we are able to detect no other difference, and it is possible that our species will prove to be a variety of *K. tæniura*. (ἀργής, bright.)

*Kuhlia arge*, Jordan & Bollman, Proc. U. S. Nat. Mus., 1889, 159, Chatham Island, Galapagos Archipelago; (Type, No. 41169. Coll. Albatross); Jordan & Eigenmann, *l. c.*, 419, 1890.

### 1412. KUHLIA XENURA (Jordan & Gilbert).

Head 3¼; depth 2⅜; eye very large, 2⅗ in head. D. IX-I, 11; A. III, 11; scales 7–51–12. Maxillary barely reaching front of pupil; gill rakers long and slender, 9 + 24; pectorals 2½ in head; ventrals scarcely reaching vent; longest dorsal spine 1½ in head. Body deep and compressed. Color olivaceous above, silvery below; caudal fin plain. Tropical seas; probably west coast of Central America; known from two specimens in the U. S. National Museum, bearing the label "San Salvador. J. M. Dow." But it is possible that they were brought by Dr. Stimpson from China, and *Kuhlia xenura* may not be an American fish at all. (*ξένος*, strange; *οὐρά*, tail; the tail being more deeply forked than in *Xenichthys*.)

*Xenichthys xenurus*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1881, 454, supposed to come from San Salvador. (Type, No. 4356.)

*Kuhlia xenura*, Jordan & Gilbert, Proc. U. Nat. Mus., 1882, 376 (locality questioned); Jordan & Eigenmann, *l. c.*, 419, 1890.

## Family CXLIII. PERCIDÆ.

### (The Perches.)

Body more or less elongate, terete or compressed, covered more or less completely with rather small, ctenoid, adherent scales. Dorsal and ventral outlines more or less unlike. Lateral line usually present, not extending on the caudal fin. Mouth terminal or inferior, small or large, the premaxillaries protractile or not; maxillaries large or small, without distinct supplemental bone. Jaws, vomer, and palatines with bands of teeth, which are usually villiform, but sometimes mixed with canines; occasionally the teeth on the vomer or palatines are absent. Head naked, or more or less scaly; preopercle entire or serrate; opercles usually ending in a flat spine. Branchiostegals 6 or 7. Gills 4, a slit behind the fourth; gill membranes free or connected, not joined to the isthmus; gill rakers slender, toothed; pseudobranchiæ small, or glandular and concealed, or altogether wanting; lower pharyngeals separate, with sharp teeth. Anal papilla usually more or less developed. Fins generally large; 2 dorsals, the first of 6 to 15 spines; anal fin with 1 or 2 spines, the usual number 2. Ventrals thoracic, I, 5; pectorals often very large; caudal lunate, truncate, or rounded. Air bladder small and adherent, often entirely wanting. Pyloric cœca few. No subocular lamina of the suborbitals; entopterygoid present. Anterior vertebræ without transverse processes; only the first pterygial or actinost usually in contact with the coracoid; sometimes a part of the second also. The posterior processes of the premaxillaries are short; the supraoccipital and parietal bones are short and confined to the back of the skull; parietal crests are absent, and the supraoccipital crest is very short, not extending to the anterior extremity of the bone, or even absent. Vertebræ 30 to 48, always more than 10, 13 to 25 in the precaudal portion. Genera about 23 (12 to 25); species about 120; inhabitants of the fresh waters of cool regions in the Northern Hemisphere, most of them being confined to eastern North America or to Europe. The great majority of the species belong to the subfamily *Etheostominæ* (the Darters) all the species of which group are American. They are among the most singular and interesting of our fishes. They differ from the typical *Percinæ* in their small size, bright colors, and large fins, and more technically in the rudimentary condition of the pseudobranchiæ and the air bladder, both of which organs are usually inappreciable. The preopercle is unarmed, and the number of branchiostegals is 6. The anal papilla is likewise developed, as in the *Gobiidæ*, to which group the darters bear a considerable superficial resemblance, which, however, indicates no real affinity. The relations of the darters to the perches have been aptly expressed by Prof. Stephen A. Forbes: "Given a supply of certain kinds of food nearly inaccessible to the ordinary fish, it is to be expected that some fishes would become especially fitted for its utilization. Thus the *Etheostomatinæ* as a group are explained in a word by the hypothesis of the progressive adaptation of the young of certain *Percidæ* to a peculiar place of refuge and a peculiarly situated food supply. Perhaps we may without violence call these the mountaineers among fishes. Forced from the populous and fertile valleys of the river beds and lake bottoms, they have taken refuge from their enemies in the rocky highlands, where the free waters play in ceaseless torrents, and there they have wrested from stubborn nature a meager living. Although diminished in size by their constant struggle with the elements, they have developed an activity and hardihood, a vigor of life, and a glow of high color almost unknown among the easier livers of the lowerlands. * * * Notwithstanding their trivial size, they do not seem to be dwarfed so much as concentrated fishes." (Am. Nat., 1880, October, pp. 697–702.) The colors of the *Etheostominæ** are usually very brilliant, species of the *Etheostominæ* especially being among the most brilliantly colored fishes known; the sexual differences are often great, the females being as a rule dull in color and more speckled or barred than the males. Most of them prefer clear running water, where they lie on the bottom concealed under stones, darting, when frightened or hungry, with great velocity, for a short distance, by a powerful movement of the fan-shaped pectorals, then stopping as suddenly. They rarely use the caudal fin in swimming, and they are seldom seen moving or floating freely in the water like most fishes. When at rest they support themselves on their expanded ventrals and anal fin. All of them can turn the head from side to side, and they frequently lie with the head in a curved position or partly on one side of the body. The species of *Ammocrypta*, and perhaps some of the others, prefer a sandy bottom, where, by a sudden plunge, the fish buries itself in the sand and remains quiescent for hours at a time, with only its eyes and snout visible. The others lurk in stony places, under rocks and weeds. Although more than usually tenacious of vitality, the darters, from their bottom life, are the first to be disturbed by impurities in the water. All the darters are carnivorous, feeding chiefly on the larvæ of *Diptera*, and in their way voracious. All are of small size; the largest (*Percina rex*) reaches a length of 10 inches, while the smallest (*Microperca punctulata*) is, next to *Elassoma zonatum*, the smallest spiny-rayed fish known, barely attaining the length of an inch and a half. In Europe no *Etheostominæ* are found, their place being filled by the genus *Zingel* (*Aspro*), which bears a strong resemblance to the American forms, a resemblance which may be a clue as to the origin of the latter. The other European genera are *Perca*, *Lucioperca*, a near ally of *Stizostedion*, *Gymnocephalus* (*Acerina*), and *Percarina*. The separation of the *Etheostominæ* into genera is a matter of much difficulty as the structural differences are small, the individual variations great, and the gradations very perfect. We have, hitherto, been disposed to unite them all in one genus, but to do so tends to obscure the relations of the species. Dr. Boulenger *

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*The following is a popular account of the habits of these fishes: Any one who has ever been a boy and can remember back to the days of tag alders, yellow cowslips, and an angleworm on a pin hook will recall an experience like this: You tried some time to put your finger on a little fish that was lying, apparently asleep, on the bottom of the stream, half hidden under a stone or leaf, his tail bent around the stone as if for support against the force of the current. You will remember that when your finger came near the spot where he was lying, the bent tail was straightened and you saw the fish again resting, head up stream, a few feet away, leaving you puzzled to know whether you had seen the movement or not. You were trying to catch a Johnny Darter. Nothing seems easier, but you did not do it. Having by well-understood strategem succeeded where you failed, allow us to give you that acquaintance which he so deftly declined. In all clear streams from Maine to Mexico the Johnny Darters are found, and the boy who does not know them has missed one of the real pleasures of a boy's life. All of them are very little fishes, some not more than 2 inches long, and the very largest but 6 or 8. But small though they are, they are the most interesting in habits, the most graceful in form, and many of them the most brilliant in color of all fresh-water fishes. The books call them "Darters," for one of the first species known was named *Boleosoma*, and that in Greek means "dart body," a name most appropriate to them all. The realistic dwellers in the Ohio Valley call some of them "Hogfish," and the boys call them "Johnnies." Certainly the boys ought to know, and Johnnies they are, and Darters they are; so Johnnie Darters they shall be. Their first introduction to science was in 1819, when Rafinesque gave to them their scientific name *Etheostoma*. This name seems to mean "strainer mouth," but the "eccentric naturalist" whose peculiar use of the Greek language was not the least of his eccentricities, says that it means "various mouth," because no two of those he knew (*Etheostoma flabellare, Percina caprodes*, and *Diplesion blennioides*) have the mouth alike. But whatever it may mean, *Etheostoma* is their name, and Rafinesque their godfather, and we may call them Johnnies for short. Rafinesque said of the Johnnies that he knew "they are good to eat fried." I suppose that he had tried them, but we have not. We should as soon think of filling our pan with wood warblers as to make a meal of them. The good

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man goes a fishing not for "pot luck," but to let escape "the Indian within him." The Johnny has all that ardent desire for perfect freedom that is supposed to be native to this continent. Unless all appearance of captivity be concealed in a well-kept aquarium he will quickly lie on the bottom, dead. Here, at the beginning (for much as we may regret the fact, the death of some individual must precede our acquaintance with the group, and even to some extent with the individual himself), we observe two noteworthy facts, the fish in dying does not turn over, and does not rise to the surface. On dissection, we find that the air bladder is only rudimentary, being structurally but not functionally present, a distinction not without meaning in these days of evolutionary hypotheses. If our tank be so arranged that the conditions are nearly natural, there being an abundance of stones and weeds on the bottom, our Johnnies will cheerfully live with us and we shall be ready to study their individual peculiarities. For it must be known that while all fish are fish, they are so only as all men are men. The children of one family are not more unlike one another than the fishes of one brood might be if the sickly ones and the lazy ones were as carefully guarded as are ours. As it is, they have their individuality. One is constantly darting over and among the stones, never resting, moving his head from side to side when his body is for a moment still. Another will lie for hours motionless under a stone, moving only for a few inches when pushed out with a stick. These peculiarities of temperament are important factors in the problem of life, and from such differences under varying conditions, may have resulted forms which we now designate as different species.—"*The Johnny Darters*," *Jordan & Copeland*, *Amer. Nat.*, *1876*.

* Dr. Boulenger gives the following synopsis of the genera of *Percidæ*:

*I.* Head with the muciferous cavities moderately or feebly developed above and on the sides; dorsal fins distinct.

*A.* Body more or less compressed.

places them in 8 genera. We are unable, however, to stop with that number of divisions. If they are not all placed in one genus each structural type must stand as a genus by itself. (*Percidæ*, part, Günther, Cat., I, 58–78, 1859.)

*I.* Pseudobranchiæ well developed; preopercle serrate, the teeth on its lower margin antrorse; branchiostegals 7; no anal papilla; premaxillaries protractile; skull not especially cavernous; mouth large, terminal.

LUCIOPERCINÆ:

*a.* Canine teeth on jaws and palatines; body elongate.

  *b.* Ventral fins well separated, the distance between them equal to the width of their base; spines of second dorsal and anal very feeble, closely appressed to the soft rays; dorsal fins well separated; canines strong. STIZOSTEDION, 463.

PERCINÆ:

*aa.* Canine teeth none; body oblong; ventral fins near together; mouth large. PERCA, 464.

*II.* ETHEOSTOMINÆ:

Pseudobranchiæ imperfect or wanting; preopercle entire or nearly so; branchiostegals 6; anal papilla usually present; pyloric cœca 2 to 6; supraoccipital crest low or wanting; fishes of small size, all American.

  *c.* Parietal region of skull rather depressed, not strongly convex in transverse section, ⌒-shaped in section; bones of skeleton rather slender and thin; vertebræ 38 to 44.

    *d.* Cranium broad between the eyes; premaxillaries not protractile; snout conic, pig-like, projecting beyond the inferior mouth; ventrals separated by an interspace equal to the width of their base; ventral line with a series of enlarged scales which fall leaving a naked strip; dorsal spines numerous (13 to 15); gill membranes separate; scales small; vertebræ $23 + 21 = 44$; size largest of the darters. PERCINA, 465.

    *dd.* Cranium not broad between the eyes; mouth less inferior, the snout not much projecting.

      *e.* Body not hyaline nor extremely elongate, its surface almost entirely covered by scales.

        *f.* Premaxillaries not protractile, free only at the sides, the skin of the premaxillaries in front, firmly connected mesially with that of the forehead, with no cross groove between; anal fin always large, rarely smaller than second dorsal.

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1. Seven (exceptionally 8) branchiostegals; maxillary large, exposed, free behind; premaxillaries protractile; preopercle serrated.

  No canine teeth; ventrals close together. 1. PERCA.

  More or less enlarged canine teeth; ventrals separated by an interspace at least equal to ⅔ the width of their base. 2. LUCIOPERCA.

2. Six branchiostegals; maxillary small, its upper border if free, entirely or nearly entirely slipped under the preorbital.

  *a.* Maxillary free from preorbital.

    *α.* Premaxillaries free only at the sides.

  Ventrals separated by an interspace equal to the width of their base. 3. PERCINA.

  Ventrals separated by an interspace considerably less than the width of their base. 4. ETHEOSTOMA.

    *β.* Premaxillaries protractile, entirely free from the skin of the snout.

      Ventrals separated by an an interspace nearly equal to the width of their base. 5. BOLEOSOMA.

  Ventrals narrowly separated. 6. ULOCENTRA.

  *b.* Maxillary adnate to preorbital; ventrals narrowly separated. 7. DIPLESIUM.

3. Body cylindrical or somewhat depressed.

  *a.* Maxillary exposed, its upper border slipping under the preorbital; body translucent.

  Premaxillaries protractile. 8. AMMOCRYPTA.

  Premaxillaries free only at the sides. 9. CRYSTALLARIA.

  *b.* Maxillary covered by preorbital; premaxillaries free only at the sides. 10. ASPRO.

II. Head with very large muciferous cavities above and on the sides.

  Two dorsals; maxillary exposed, free behind. 11. PERCARINA.

  Dorsals united; maxillary covered by preorbital. 12. ACERINA.

*g.* Ventral fins well separated, the interspace about equal to width of their base.

*h.* Middle line of belly with more or less enlarged, caducous plates, which are shed at certain seasons, leaving a naked strip. Hadropterus, 466.

*hh.* Middle line of belly with small, persistent scales like those of sides. Hypohomus, 467.

*ff.* Premaxillaries protractile, a groove separating them from the skin of the forehead, rarely crossed by a narrow frenum in one species (*shumardi*).

*i.* Anal spines 2, both well developed, the first usually the longer, the second rarely obsolete.

*j.* Maxillary normal, free from the preorbital, except at base; vomer usually with teeth.

*k.* Anal fin rather large, scarcely smaller than second dorsal; mouth not very small; belly naked or with caducous plates, at least anteriorly; gill membranes scarcely connected, ventral fins well separated. Cottogaster, 468.

*kk.* Anal fin short and small, much smaller than second dorsal; mouth small; belly covered with ordinary scales; gill membranes broadly connected across the isthmus; ventral fins inserted close together. Ulocentra, 469.

*jj.* Maxillary adnate to the preorbital for most of its length, and therefore nearly immovable; mouth very small, inferior; no teeth on vomer; ventral fins close together. Diplesion, 470.

*ii.* Anal spine single, obscure; dorsal spines usually 9, slender; anal fin small, much shorter than soft dorsal; ventral fins well separated. Boleosoma, 471.

*ee.* Body extremely elongate, hyaline, subterete, the belly mostly naked; lateral line complete; head long, pointed; gill membranes somewhat united.

*l.* Premaxillaries not protractile, free only at the sides; dorsal spines 14; anal fin large, with 1 spine; scales very small. Crystallaria, 472.

*ll.* Premaxillaries protractile; dorsal spines 7 to 11.

*m.* Anal spine single; anal nearly as large as second dorsal; vertebræ 41 to 44; bones of skeleton very thin. Ammocrypta, 473.

*mm.* Anal spines 2; anal fin small, much smaller than second dorsal. Ioa, 474.

**cc.** Parietal region of skull not depressed, more or less strongly convex in cross-section, thus, ∩ ; premaxillaries never protractile ; belly covered with ordinary scales; ventrals inserted close together; anal fin rather small, of 7 to 9 soft rays, notably smaller than second dorsal, usually with 2 spines; vertebræ 31 to 36, the bones rather firm.

**n.** Lateral line developed, at least anteriorly; dorsal spines 8 to 14.

*o.* Lateral line straight; body rather robust.

*p.* Head naked above.

*q.* Dorsal fins large, usually with more than 7 spines. Etheostoma, 475.

*qq.* Dorsal fins small, VI–10. Alvarius, 476.

*pp.* Head completely scaled above. Psychromaster, 477.

*oo.* Lateral line with a slight arch running high anteriorly; dorsals well separated; body slender.

*r.* Head scaled above. Copelandellus, 478.

*rr.* Head naked above. Boleichthys, 479.

**nn.** Lateral line wholly wanting; fins all very short, only 6 dorsal spines; vertebræ 14 + 16 = 30. Microperca, 480.

The following are the numbers of the vertebræ in species of *Percidæ* as given by Jordan & Eigenmann and by Boulenger:

| | | | |
|---|---|---|---|
| Perca fluviatilis | 22 + 19 = 41 | Etheostoma maculatum | 15 + 24 = 39 |
| Perca flavescens | 22 + 19 = 41 | Boleichthys fusiformis | 16 + 20 = 36 |
| Lucioperca volgensis | 22 + 21 = 43 | Etheostoma variatum | 15 + 21 = 36 |
| Lucioperca sandra | 25 + 21 = 46 | Etheostoma lepidum | 16 + 19 = 35 |
| Stizostedion vitreum | 25 + 21 = 46 | Etheostoma whipplii | 15 + 21 = 36 |
| Zingel asper | 20 + 24 = 44 | Etheostoma flabellare | 13 + 20 = 33 |
| Zingel zingel | 22 + 26 = 46 | Microperca punctulata | 14 + 16 = 30 |
| Percarina demidoffii | 14 + 19 = 33 | Cottogaster copelandi | 18 + 20 = 38 |
| Acerina cernua | 15 + 19 = 34 | Boleosoma camurum | 17 + 21 = 38 |
| Percina caprodes | 23 + 21 = 44 | Boleosoma nigrum | 15 + 22 = 37 |
| Hadropterus aspro | 19 + 23 = 42 | Ulocentra simotera | 15 + 23 = 38 |
| Hadropterus evides | 18 + 22 = 40 | Diplesion blennioides | 19 + 23 = 42 |
| Hadropterus phoxocephalus | 19 + 20 = 39 | Ammocrypta pellucida | 23 + 21 = 44 |
| Hadropterus scierus | 18 + 22 = 40 | Ammocrypta vivax | 21 + 20 = 41 |
| Etheostoma zonale | 16 + 23 = 39 | | |

## 463. STIZOSTEDION,* Rafinesque.

### (American Pike Perches.)

*Stizostedion*, Rafinesque, Ichth. Ohiensis, 23, 1820, (*salmonea*).
*Pomacampsis*, Rafinesque, Ichth. Ohiensis, 23, 1820, (*nigropunctata*; mythical).
*Cynoperca*, Gill & Jordan, Bull. U. S. Nat. Mus., x, 44, 1877, (*canadense*).
*Stizostedium* or *Stizostethium*, amended spelling.

Body elongate, fusiform, the back broad. Head subconical, long. Cheeks, opercles, and top of the head more or less scaly. Mouth large, the jaws about equal; premaxillaries protractile, little movable. Teeth in villiform bands, the jaws and palatines with long, sharp canines. Gill rakers slender, strong; gill membranes separate. Preopercle serrated, the serræ below turned forward; opercle with 1 or more spines, terminations of radiating striæ. Dorsal fins well separated, the first with 12 to 15 spines, the second with 17 to 21 soft rays; last dorsal spine not erectile, bound down by membranes; anal spines 2, slender, closely appressed to the soft rays, which are rather long, 11 to 14 in number. Ventral fins well separated, the space between them equal to their base; ventral spine slender, closely appressed to the soft rays. Scales small, strongly ctenoid; lateral line continuous. Branchiostegals 7. Pseudobranchiæ well developed. Pyloric cœca 3 to 7. Two species, differing considerably from each

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*The genus *Stizostedion* is closely related to the European genus *Lucioperca*, Cuvier (type *Perca lucioperca*, L.). From *Lucioperca*, however, it differs sufficiently in the wide-set ventrals and in the weak development of the anal and ventral spines, which are closely approximated to the soft rays. The dorsals in *Lucioperca* are slightly connected. The name *Lucioperca*, according to Boulenger, "should date from the first edition of the Règne Animal, 1817, when Cuvier (p. 295) does use the Latin name [as well as the French plural '*Les Sandres*'] ('ce qui leur a fait donner le nom de *lucio-perca*') although indirectly and without a capital." (Boulenger, Proc. Zoöl. Soc. Lond., 1892, 411.) But, as Dr. Gill has shown, this is too great a strain on the words of Cuvier, who "simply stated a historical fact and did not formulate a nomenclatural proposition." In other words, Cuvier states that the name *Lucioperca* was used by Gesner, but to the genus to which Gesner's *Lucioperca* belongs he supplies only the French name "*Les Sandres*," and *Lucioperca* can only date from its use by Fleming, Phil. of Zoöl., 394, 1822. Since that time, the names *Sandat*, Cloquet, 1827; *Sandrus*, Stark, 1828, and *Schilus*, Krynicki, 1832, have been applied to the type of *Lucioperca*. See Boulenger, *l. c.*, and Gill, Proc. U. S. Nat. Mus., 1894, 123, for discussions of the relationships and nomenclature of the Pike Perches.

other. Large, carnivorous fishes of the fresh waters of North America. (στίζω, to prick; στηθίον, a little breast; "the name means pungent throat," according to Rafinesque; the substitution of *stedion* for *stethion* apparently suggested by the name *Peristedion.*)

STIZOSTEDION:

*a.* Pyloric cœca 3, subequal, each as long as the stomach; soft dorsal long, its base ⅙ shorter than spinous dorsal, of about 20 soft rays.

*b.* Cheeks and upper surface of head sparsely scaled; body somewhat compressed; a black blotch on last dorsal spines; no black blotch on base of pectoral; second dorsal simply mottled. VITREUM, 1413.

CYNOPERCA (κύων, dog; πέρκη perch):

*aa.* Pyloric cœca unequal, 4 of them of moderate length, much shorter than stomach, the others 1 to 3 in number, smaller and variable, some or all of them sometimes wanting; soft dorsal shorter, its base ¼ shorter than spinous dorsal, of about 17 soft rays.

*c.* Cheeks and upper surface of head more or less closely scaled; body terete; no black blotch on last dorsal spines; a black blotch at base of pectoral; second dorsal with rows of dark spots. CANADENSE, 1414.

## Subgenus STIZOSTEDION.

### 1413. STIZOSTEDION VITREUM (Mitchill).

(WALL-EYED PIKE; PIKE PERCH; DORY; GLASSEYE; YELLOW PIKE; BLUE PIKE; JACK SALMON; WHITE-EYE.)

Head 3⅔; depth about 4½; eye shorter than snout, 4½ to 5 in head. D. XII to XVI, 19 to 21; A. II, 12 to 14; scales 10–110 to 132–25, 83 to 95 pores. Body slender, becoming compressed with age, the back more arched than in *Stizostedion canadense.* Cheeks and upper surface of head nearly naked. Dorsal spines high, more than half length of head; dorsal fins well separated, the interspace between them greater than diameter of eye, the last dorsal spine scarcely erectile; soft dorsal nearly as long as spinous dorsal; anal longer than high. Pyloric cœca 3, rather long. Dark olive, finely mottled with brassy, the latter color forming indistinct oblique lines; sides of head more or less vermiculated; lower jaw flesh colored; belly and lower fins pinkish; spinous dorsal with a large jet-black blotch on the membrane of the last 2 or 3 spines, otherwise nearly plain; second dorsal and caudal mottled olive and yellowish; base of pectoral dusky, without distinct black blotch. Great Lake region, Upper Mississippi, north to Assiniboia, east to Vermont and Pennsylvania, south to Georgia and Alabama, especially common northward; an abundant and valued food-fish, reaching a length of 3 feet and a weight of 10 to 20 pounds. (*vitreus*, glassy, from the large eye.)

*Perca vitrea*, MITCHILL, Supp. Amer. Month. Magazine, II, 247, 1818, Cayuga Lake, New York.

*Perca salmonea*,* RAFINESQUE, Amer. Month. Magazine, V, 354, 1818, Ohio River.

*Perca* (*Pomacampsis*) *nigropunctata*, RAFINESQUE, Ichth. Ohiensis, 23, 1820, mythical; on a drawing by Audubon, not intended to represent any fish.

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* The name *salmoneum* has been applied to the so-called "Blue Pike" originally described from the Ohio River, but more common in the Great Lakes, particularly Ontario and Erie. It is smaller and deeper in body than the ordinary *vitreum* and different in color, but it is not likely that any permanent distinctions exist, this species, as usual among fresh-water fishes, varying largely with the environment and with age.

*Lucioperca americana*, Cuvier & Valenciennes, Hist. Nat. Poiss., II, 122, 1828, New York; Günther, Cat., I, 74, 1859.
*Stizostedium vitreum*, Jordan & Gilbert, Synopsis, 525.
*Lucioperca vitrea*, Boulenger, Cat., I, 55.

### Subgenus CYNOPERCA, Gill & Jordan.

### 1414. STIZOSTEDION CANADENSE (Smith).

(Sauger; Sand Pike.)

Head 3½; depth 4½ to 6; eye 5 in head. D. XI to XV–I, 17 to 19; A. II, 11 or 12; scales 9–100 to 125–27; pores in lateral line, 80 to 95; vertebræ 23 + 22; pyloric cœca 4 to 7, unequal in length. Body elongate, more terete than in *Stizostedion vitreum*, the flesh more translucent; head depressed, pointed; opercular spines variable. Olive gray, sides brassy or orange, with dark mottlings, more distinct in the young, which are sharply marked; first dorsal with 2 or 3 rows of round, black spots, no black blotch on last spines; second dorsal with 3 irregular rows of dark spots; a large black blotch on base of pectoral; caudal dusky and yellowish. Northeastern North America, from Pennsylvania to Tennessee, Arkansas, and the Upper Missouri, especially abundant northward; a smaller fish than *S. vitreum* and of much less value as food. The typical *canadense* is from the St. Lawrence region, much less widely distributed than the variety *griseum*, from which it differs in having the opercles and bones of the head considerably rougher, the number of the opercular spines (which are merely the free ends of the striæ) increased, and the head more closely and extensively scaled.

*Lucioperca canadensis*, C. H. Smith MS. in Griffith's edition of Cuvier's Règne Animal, Fishes, 275, pl. 1, 1834, Canada; Boulenger, Cat., I, 54.
*Stizostedium canadense*, Jordan & Gilbert, Synopsis, 526, 1883.

Represented in the Great Lake region and southwestward to Kentucky and Arkansas by

### 1414a. STIZOSTEDION CANADENSE GRISEUM (DeKay).

(Sauger; Sand Pike; Gray Pike; Pickering.)

This is the common Sand Pike or Sauger of the Great Lake region and southwestward. It differs from the typical *canadense* chiefly in the smoother opercles and head bones, the fewer opercular spines, and the less complete scaling of the head. The two need fuller comparison and may prove to be distinct species, but this is unlikely. Length 10 to 18 inches. (*griseus*, gray.)

*Lucioperca grisea*, DeKay, New York Fauna: Fishes, 19, 1842, New York.
*Lucioperca pepinus*, Estes in Hallock's Sportsman's Gazetteer, 322, 1877, Lake Pepin. (Coll. D. C. Estes.)

### 1414b. STIZOSTEDION CANADENSE BOREUM (Girard).

This is the form found in the Upper Missouri Basin, and differs from *griseum* chiefly in the more slender head, which has a snake-like aspect. (*boreus*, northern.)

*Lucioperca borea*, Girard, Proc. Ac. Nat. Sci. Phila., 1857, 201, Fort Sarpi, Nebraska.

### 464. PERCA (Artedi), Linnæus.

### (River Perch.)

*Perca* (Artedi) Linnæus, Systema Naturæ, Ed. x, 1758, i, and Ed. xii, i, 481, 1756, (*fluviatilis*)
*Epitrachys*, Schulze, Journ. Ber. Ver. Magdeburg, 1889, 209, (*fluviatilis*).

Body oblong, somewhat compressed, the back elevated. Cheeks scaly; opercles mostly naked; the operculum armed with a single spine; preopercle and shoulder girdle serrated; preopercle with retrorse, hooked serrations below. Mouth moderate, terminal; premaxillaries protractile; teeth in villiform bands on jaws, vomer, and palatines; no canine teeth. Branchiostegals 7. Gill membranes separate; pseudobranchiæ small, but perfect; no anal papilla. Scales rather small, strongly ctenoid, lateral line complete, the tube straight and not extending to the extremity of the scale. Dorsal fins entirely separate, the first of 12 to 16 spines; anal fin with two slender spines, well separated from the soft rays; ventral spines well developed, the ventral fins near together; caudal emarginate; air bladder present. Pyloric cœca 3; vertebræ very numerous, 21 + 20 or 21 = 41 or 42. Fresh waters of northern regions; three closely-related species now known—*Perca fluviatilis* in Europe, *P. schrenkii* in Asia, and *P. flavescens* in North America. This genus has long been considered the type of the spiny-rayed fishes, and in many systems it has been placed first in the series of fishes. *Perca* is, however, a comparatively recent and somewhat aberrant type, and in no sense entitled to be regarded either as the first or the center of the spiny-rayed series. The great group of *Percoidea* occupies in some sense a central position among the *Acanthopterygii* and the characteristic spinous armature is here most typical in character. But the genus *Perca* is neither central nor typical among the *Percoidea*. That position is more properly to be assigned to *Epinephelus*. (*πέρκη*, *Perca*, the ancient name of *Perca fluviatilis*, from *πέρκος*, dusky.)

#### 1415. PERCA FLAVESCENS (Mitchill).

#### (Yellow Perch; American Perch; Ringed Perch; Raccoon Perch.)

Head 3¼; depth 3¼. D. XIII to XV–II, 13 to 15; A. II, 7 or 8; scales 7–74 to 88–17, 54 to 62 with pores. Back highest at origin of spinous dorsal, which is more or less behind insertion of pectoral; profile convex from dorsal to occiput, thence concave anteriorly, the snout projecting, a little longer than eye. Mouth somewhat oblique, maxillary not quite reaching opposite middle of orbit. Gill rakers x + 15, the longest ⅓ to ¾ length of branchial filaments. Cheeks closely scaled throughout, the scales imbricated; opercular striæ and rugosities on top of head well marked. First anal spine longer than first dorsal spine; first dorsal spine inserted above or a little behind base of pectoral. Pseudobranchiæ quite small. Gill rakers stout, shortish. Back dark olivaceous; sides golden yellow; belly pale; sides with 6 or 8 broad, dark bars, which extend from the back to below the axis of the body; lower fins largely red or orange; upper fins olivaceous; with or without a distinct black spot on anterior or posterior part of spinous dorsal. Length 1 foot. Fresh waters of the eastern United States, chiefly northward and eastward; abundant in the Great Lakes and in coastwise streams from Nova Scotia to North Carolina, common in the tributaries of the upper Mississippi, especially in Iowa and Minnesota, west to the Dakotas; unknown from central Ohio southwest; abundant in the lakes of northern Indiana; not known from the Ohio River or the lower Missouri. A familiar, handsome, and active fish of fair quality as food, the flesh not rich in flavor. (*flavescens*, yellowish.)

*Perca americana*, Schranck, Abh. Privalges. Oberdeutschland, I, 1792, America, (not *Perca americana*, Gmelin, 1788); Jordan & Gilbert, Synopsis, 524, 1883.

*Morone flavescens*, Mitchill, Rept. Fish. N. Y., 18, 1814, near New York City.

*Centropomus luteus*, Rafinesque, Précis des Découvertes Somiologiques, 19, 1814, Pennsylvania, probably.

*Perca notata*, Rafinesque, Amer. Monthly Mag., Jan., 1818, 205, Lake Erie. (Coll. Gov. DeWitt Clinton.)

*Perca serratogranulata*, Cuvier & Valenciennes, Hist. Nat. Poiss., II, 47, 1828, New York.

*Perca granulata*, Cuvier & Valenciennes, Hist. Nat. Poiss., II, 48, pl. IX, 1828, New York.

*Perca acuta*, Cuvier & Valenciennes, Hist. Nat. Poiss., II, 49, pl. X, 1828, Lake Ontario.

*Perca gracilis*, Cuvier & Valenciennes, Hist. Nat. Poiss., II, 50, 1828, Skaneateles Lake, New York.

*Bodianus flavescens*, Mitchill, Trans. Lit. and Philos. Soc. N. Y., 1815, 421.

*Perca flavescens*, Cuvier & Valenciennes, Hist. Nat. Poiss., II, 46, 1828; Günther, Cat., I, 59, 1859, Boulenger, Cat., I, 48, and of authors generally.

*Perca fluviatilis flavescens*, Steindachner, Sitzgber, Ak. Wien, LXXVIII, 1878, 24.

## 465. PERCINA, Haldeman.

### (Log Perches.)

*Percina*, Haldeman, Journ. Ac. Nat. Sci. Phila., VIII, 1842, 330, (*nebulosa*).

*Pileoma*, De Kay, New York Fauna: Fishes, 16, 1842, (*semifasciatum*).

*Asproperca*, Heckel, Canestrini, Systema der Percoiden, 311, 1860, (*zebra*).

Body elongate, slightly compressed, covered with small, ctenoid scales; Lateral line continuous; ventral line with enlarged plates, which fall off, leaving a naked strip. Head depressed, rather pointed, the mouth being small and inferior, overlapped by a tapering, subtruncate, pig-like snout; upper jaw not protractile. Maxillary small, exposed. Teeth on vomer and palatines. Gill membranes scarcely connected. Dorsal fins well separated, the first the larger, of 13 to 15 spines; the second dorsal rather longer than the anal, which has two spines, the first of which is usually the shorter. Pectorals symmetrical, rounded, or bluntly pointed, their rays 14 or 15, their spines moderate; ventral fins well separated, the interspace about equal to their base. Air bladder and pseudobranchiæ present, rudimentary.* Vertebræ (*P. caprodes*) $23+21=44$. General

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* So far as the cranium is concerned, *Perca* is probably nearer *Percina* than either is to *Stizostedion*. Comparing the skull of *Percina* with that of *Perca*, we find that in the former the bones of the skull above are much smoother; the ridges and grooves of the frontal, parietal, and mastoid regions conspicuous in *Perca*, are nearly obsolete in *Percina*. The tube-like pores on the frontal bones, conspicuous in *Perca*, are barely visible in *Percina*. Parietals and supraoccipital with radiating striæ, more regular than in *Perca*, the ridges lower and less sharp. Frontal region narrower than in *Perca*, and less depressed. Supraoccipital bone larger than in *Perca*, its crest very much smaller, not rising to level of occiput. Sutures of skull more distinct than in *Perca*. Skull in profile less convex at occiput, more elevated between eyes.

Post-temporal in *Percina* trifurcate, the forks slender, the posterior part without serration; its form similar to that of *Perca*. Scapula L-shaped, thinner and weaker than in *Perca*; its edge pattern of coloration olivaceous, with dark vertical bands alternatly long and short. Size, largest of the darters, approaching that of *Aspro*, to which genus it is more nearly related than the other darters are. (A diminutive of *Perca*.)

*a*. Body deep; the depth more than $\frac{1}{5}$ the length; body with orange shades in life. REX, 1416.

*aa*. Body subterete, the depth not more than $\frac{1}{5}$ the length; no orange shades in life. CAPRODES, 1417.

### 1416. PERCINA REX, Jordan & Evermann.

Head $3\frac{5}{6}$; depth $4\frac{3}{5}$. D. XIV–15; A. II, 11; scales 11–83 to 85–19, 5 rows of small scales on cheek. Body elongate, little compressed, the form more robust than in *Percina caprodes*, the back more elevated; head stouter, the snout more acuminate, and the mouth a little larger than in *P. caprodes*; the head similarly formed. Opercles and nape closely scaled; breast naked; gill membranes nearly separate; pseudobranchiæ very small; median scales on ventral line moderately enlarged. Fins higher than in *P. caprodes*, the longest ray of the soft dorsal slightly more than half head. Adult, in spirits, mottled green above, yellowish below; 4 dark cross blotches on back; about 10 roundish dark blotches on sides, these almost confluent into a band; a small black spot at base of caudal; no trace in young or old of parallel cross bands on side of back, the young with the back covered with zigzag markings, the sides with 10 short, vertical, inky black blotches about as high as the eye; second dorsal and caudal in adult yellowish, with oblique cross stripes of black spots; first dorsal yellowish, mottled, with a median dusky

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not serrate. Foramen of hypercoracoid much larger than in *Perca*. Pelvic bones proportionately shorter and broader than in *Perca*. Rest of skeleton essentially as in *Perca*; number of vertebræ, 23 + 21 = 44. Lower pharyngeals triangular-elliptical, with large teeth.

As compared with the other darters, the skull of *Percina* is much broader between the eyes; the parietal bones are more strongly ridged, the sutures more distinct, the top of the cranium beyond the eyes more depressed, and the supraoccipital crest more developed than in most of the others. In all these respects *Percina* is intermediate between *Perca* on the one hand, and the extreme forms, *Ammocrypta* and *Microperca*, on the other.

The other darters form two irregular lines, the one with depressed cranium, and slenderer bones, culminating in *Ammocrypta*; the other having the cranium more convex transversely, the bones firmer and smooth, and the vertebræ fewer in number. This group seems to culminate in *Microperca*.

So far as the skeletons are concerned, we seem to be justified in the following inferences:

1. The *Etheostominæ* are near allies of the *Percinæ*, and should not form a separate family.

2. They are among themselves closely related, and the extreme forms are so connected by intermediate forms that they might with no great violence to nature be regarded as forming a single genus.

3. The species nearest allied to the typical *Percinæ* is *Percina caprodes*. This is the largest in size, and of the others in general those smallest in size are most aberrant in structure.

4. Those species which have usually been grouped together on external characters agree in general in regard to the skeleton.

5. As most of the skeletal characters change by degrees, none of them is of much use in defining genera.

6. These skeletal characters apparently of most importance are in the structure of the mouth, the breadth of the frontal region (*Percina*), the number of vertebræ, and the outline of the transverse section of the skull across the parietals, whether ⌒ as in *Boleosoma*, etc., or ∩, as in *Etheostoma*. The prolongations of the frontals in *Etheostoma flabellare* and in *Hadropterus phoxocephalus* and its shortness in *Etheostoma zonale* seem to be purely specific characters. The development of the nearly obsolete supraoccipital crest, the distinctness of the sutures, and the sculpture of the parietals are features which offer no basis for trenchant division, except, perhaps, as distinguishing *Percina* from all the others.

7. As defined by skeletal characters alone, we may distinguish *Percina*, *Etheostoma*, *Microperca*, and perhaps *Diplesion* and *Ammocrypta* from the rest as a distinct genera. The other groups, if retained, must be separated from these and from each other by other characters.—*Jordan & Eigenmann, Proc. U. S. Nat. Mus., 1885, 71.*

band; pectorals yellow, banded with olive; anal faintly spotted with black. In life the adult example was olive green, straw color below; back with 5 obscure, dusky, cross blotches; 9 obscure, dark, olive cross blotches on sides; a small, dark, caudal spot; snout and nape dashed with orange; cheeks yellow; first dorsal pale olive, with darker olive spots at base; a broad band of brilliant orange toward margin, the edge dusky; soft dorsal and caudal light yellow, with bands of black spots; anal pale yellow, with 2 rows of olive spots; pectorals and ventrals yellow, with olive spots; ventrals edged with orange. The smaller specimen had the dark blotches on side inky black, the back more sharply mottled, and the orange on dorsal very faint. Length of type 5½ inches. Two specimens of this species were taken in swift water in the Roanoke River, near the city of Roanoke, Virginia. A splendid fish, probably the largest of all the darters, looking like a *Lucioperca*. (*rex*, king.)

*Etheostoma rex*, JORDAN & EVERMANN, Proc. U. S. Nat. Mus., 1888, 357, pl. XLV, fig. 9, Roanoke River, near Roanoke, Virginia. (Type, No. 39858. Colls. Jordan, Evermann and Jenkins.)

*Percina rex*, BOULENGER, Cat., I, 59.

### 1417. PERCINA CAPRODES (Rafinesque).

(LOG PERCH*; ROCKFISH; HOG MOLLY; HOGFISH.)

Head 4 to 4¾; depth 5 to 6½; eye 1½ in snout, 4 in head. D. XIII to XVII-12 to 17; A. II, 9 to 12; scales 9-90 to 95-15, pores 76 to 93. Body elongate, compressed. Head long and pointed, depressed and sloping above. Mouth small, quite inferior, the maxillary not reaching to the front of the eye. Cheeks, opercles, and nape scaly (the nape naked in var. *zebra*); chest naked. Fins rather low. Middle line of belly with a row of enlarged caducous scales; pectoral about as long as head; anal spines feeble, subequal, or the second the longer; caudal truncate; vertebræ 23 + 21 = 44. Color yellowish green, or yellow, with about 15 transverse dark bands from the back to the belly, these usually alternating with shorter and fainter ones, which reach about to the lateral line; a black spot at the base of the caudal; fins barred. Length 6 to 8 inches. Great

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* The Log Perch is the giant of the family, the most of a fish, and therefore the least of a darter. It may be readily known by its zebra-like colors. Its hue is pale olive, silvery below, darker above. On this ground color are about 15 black vertical bars or incomplete rings, alternating with as many shorter bars which reach only halfway down the side. The hindmost bar forms a mere spot on the base of the tail, and there are many dots and speckles on the fins. The body is long and slender, spindle-shaped, and firm and wiry to the touch. The head is flat on top and tapers into a flat-pointed snout which is squared off at the end like the snout of a pig, and this resemblance is heightened by the form of the small mouth underneath it. From this pig-like snout has come the scientific name *caprodes*. This is a translation of the older name of "hogfish," which Rafinesque heard applied to it in his time and which is still used in the same regions. *Percina* reaches a length of 6 or 8 inches and it may readily be caught on a small hook baited with a worm. We often meet an urchin with two or three of them strung through the gills on a forked stick along with "red-eyes," "stone toters," "hornyheads," and other "boys' fish.". We find *Percina* usually in rapid and rather deep water. We rarely find them small enough for ordinary aquarium purposes; and the living specimen before us, though wonderfully quick and graceful in its movements, has shown little that is noteworthy, save his courage, his fondness for angleworms, and a possible disposition to bury himself in the sand. There is something in the expression of his face, as he rests on his "hands and feet" on a stone, that is remarkably lizard-like, suggesting the Blue-tailed Skink (*Eumeces fasciatus*). —*Jordan & Copeland, 1876.*

Lakes and streams of the south and west from Quebec to Lake Superior and Iowa and south to Mississippi and the Rio Grande, chiefly in swift gravelly streams of some depth, not in brooks; a large darter, readily taking the hook, and abundant in most localities. (*κάπρος*, pig; *εἶδος*, resemblance.)

*Sciæna caprodes*, Rafinesque, Amer. Month. Mag., 1818, 534, Ohio River.

*Percina nebulosa*, Haldeman, Journ. Ac. Nat. Sci. Phila., 1842, 330, Susquehanna River, Pennsylvania.

*Pileoma semifasciatum*, De Kay, N. Y. Fauna: Fishes, 16, pl. 50, fig. 162, 1842, Lake Champlain, at Westport, N. Y.

*Percina bimaculata*, Haldeman, Proc. Bost. Soc. Nat. Hist., 1844, 157, Susquehanna River, Pennsylvania.

*Pileoma carbonaria*, Baird & Girard, Proc. Ac. Nat. Sci. Phila., 1853, 387, Rio Salado; Rio Medina; San Pedro Creek, Texas. (Type, Nos. 740; 742. Coll. Clark; Kennerly.)

*Asproperca zebra*, Heckel, Canestrini, Verh. Ges. Wien., x, 311, 1860.

*Etheostoma caprodes*, Rafinesque, Ichth. Ohiensis, 38, 1820; Mœnkhaus,* Amer. Nat., 1894, 641, pl. 18 and 19.

*Pileoma nebulosa*, Vaillant, Recherches, 51, 1873.

*Pileoma bimaculata*, Vaillant, Recherches, 52, 1873.

*Percina caprodes*, Jordan & Gilbert, Synopsis, 499; Boulenger, Cat. i, 57, and of writers.

Represented in lakes northward by

### 1417a. PERCINA CAPRODES ZEBRA (Agassiz).

(Manitou Darter.)

Head 4¼; depth 7. D. XV–14; A. II, 10; scales 90. Nape always naked. Lateral black bars short, shorter than in *caprodes*, not extending much above lateral line; these also more or less confluent, about 20 in number; a black caudal spot; dorsal and caudal mottled. Lakes of northern Indiana, Michigan, Wisconsin and northward to Lake Superior; the common form in the Great Lakes. The typical *zebra* is well distinguished from *caprodes*, but specimens variously intermediate have been obtained in Illinois by Dr. Forbes and in the Potomac by Dr. Bean. (*zebra*, a striped wild horse; from the color.)

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* This paper gives an interesting study in specific variations. The following are some of the conclusions reached by Mr. Mœnkhaus in regard to individual variation in *Percina caprodes*:

1. The variation between the specimens of a single locality is very slight.
2. The most complicated color pattern can be connected with the simplest by a series of intermediate stages.
3. The variation in color pattern can not be connected with the latitude inhabited by the different varieties. The color variation is determined, but not in a direct line north and south.
4. The simplest color pattern of the body, found only in immature specimens, consists of 9 transverse bars.
5. The simplest color pattern of adults, consists of the 9 bars seen in the young plus half bars between each two of the primary bars.
6. The next complication arises by the addition of quarter bars. These bars are first introduced in the region between the two dorsals, from which region variation seems to radiate.
7. Another complication may be the splitting of the bars into reticulations on the back and their intensification into larger spots along the sides.
8. As to dorsal rays, XV, 15 is the commonest combination, XIV, 16 the next, XV, 16 and XVI, 15 the next, and so on. The largest per cent of any combination does not exceed 21.052.
9. The average number of dorsal spines is $15\frac{5}{76}$, while the number of spines predominating is XV.
10. The average number of soft dorsal rays is $15\frac{6}{19}$, about the same as the spines—15 is seen to be the number in about 50 per cent of all the specimens examined. While 42.11 per cent have XV dorsal spines, and 50.007 per cent have 15 dorsal rays, only 21.05 per cent have a combination of XV spines and 16 rays.
11. It will be seen that the prevailing numbers of dorsal rays occuring in the more northern streams are XIV, 15. As we go farther south the usual number is XV, 16, and in the most southern streams the numbers are 15, 16, and 17 spines; the specimens from Texas are peculiarly poor in the number of spines.
12. The soft rays do not show the same variation found in the dorsal spines, the number being the same for localities north and south. The average number of dorsal spines and rays combined consequently increases with the dorsal spines.
13. In the anal rays we have, as in the dorsal spines, a slight increase in their number from north to south. The most common number in the Indiana streams is 10, the number increasing to 11 and 12 in the most southern specimens.—*Mœnkhaus, l. c.*

*Pileoma zebra*, AGASSIZ, Lake Superior, 308, 1850, Lake Superior; VAILLANT, Recherches, 48, 1873, with plates.

*Percina manitou*, JORDAN, Proc. Ac. Nat. Sci. Phila., 1877, 53, Lake Manitou, Rochester, Indiana.

*Percina caprodes manitou*, JORDAN & GILBERT, Synopsis, 500, 1883.

## 466. HADROPTERUS, Agassiz.

### (BLACK-SIDED DARTERS.)

*Hadropterus*, AGASSIZ, Amer. Journ. Sci. and Arts, 1854, 305, (*nigrofasciatus*).

*Etheostoma*,* AGASSIZ. Amer. Journ. Sci. and Arts, 1854, 305, ("*blennioides*" (not of RAFINESQUE = *aspro*).

*Alvordius*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 68, (*maculatus*).

*Plesioperca*, VAILLANT, Recherches sur Poissons des Eaux Douces, Etheostomatina, (*anceps*).

*Ericosma*, JORDAN & COPELAND, Bull. x, U. S. Nat. Mus., 8, 1877, (*evides*).

*Serraria*, GILBERT, Proc. U. S. Nat. Mus., 1884, 205, (*scierus*).

Body rather elongate, compressed or not. Mouth rather wide, terminal, the lower jaw included, the snout above not protruding beyond the premaxillaries, which are not protractile. Teeth on vomer and usually on palatines, also. Gill membranes separate or more or less connected. Scales small, ctenoid, covering the body. Belly with a median series of more or less enlarged spinous plates or ctenoid scales, which in most species fall off at intervals, leaving a naked strip; in some species persistent and but slightly enlarged; sides of head scaly or not; lateral line complete or nearly so. Fins large, the soft dorsal smaller than the spinous or the anal; anal spines 2 (one of them very rarely obsolete); dorsal spines 10 to 15. Ventral† fins more or less widely separated, especially in species with caducous plates. Vertebræ 39 to 44, 19 + 23 = 42 (*H. aspro*); 18 + 22 = 40 (*H. evides*); 18 + 22 = 40 (*H. scierus*); 19 + 20 = 39 (*H. phoxocephalus*). Parietal region more or less depressed, not strongly convex in cross section; supraoccipital crest usually present, but small. Pyloric cœca 2 to 4. Coloration bright; often brilliant; sides usually with dark blotches. The most active and graceful of the darters and many of them with most attractive coloration. This group exhibits large variation in minor characters, some of its species approaching very close to those of *Etheostoma*, the dividing line between the two genera being somewhat arbitrary. It seems best not to regard the subdivisions of this group as distinct genera, as the characters which separate them disappear by degrees. (*ἀδρός*, strong; *πτερόν*, fin.)

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* The name *Etheostoma* can not be used for this group as none of its species was known to Rafinesque, who based the genus *Etheostoma* on *caprodes*, *blennioides*, and *flabellare*.

† This character of the separation of the ventrals "by an interspace equal to the width of their base" was first introduced as a generic feature by Dr. Boulenger (Cat. Teleostean Fishes, I, 45). It is used by him to separate *Percina* (= *Percina* + *Alvordius*) from *Etheostoma* (= *Etheostoma* + *Hypohomus* + *Serraria* + *Hadropterus* proper + *Pœcilichthys* + *Boleichthys* + *Alvarius*, etc.), in which the ventrals are said to be "separated by an interspace considerably less than the width of their base." In like manner *Boleosoma* (including *Cottogaster*) is separated from *Ulocentra* and *Diplesion*, the former having the ventrals widely separated. In *Ammocrypta* the interspace is equal to the width of the base. To ascertain the value of this character we have, with the assistance of Dr. Meek, examined most of the species of *Etheostominæ*. We find that in the extreme forms, *Percina*, *Crystallaria*, *Boleosoma*, *Ammocrypta* on the one hand, the ventrals are widely separated, as stated by Dr. Boulenger. On the other hand, in species related to *Etheostoma flabellare* and *E. cæruleum*, they are very close together. Between these extremes, however, we find every gradation. This character, like other characters, shading off by degrees, and many of those species described by Dr. Boulenger as having the fins close together, would be placed by us rather with the others. The comparison of the interspace with the width of the base of the fin is not wholly satisfactory, as the base of the fins appears broader in the males with enlarged rays and narrower in the young. In general those species with the most elevated crania have the ventrals nearest together, a character usually going with small anal fin and short first dorsal, except among the allies of *Ammocrypta* and *Boleosoma*. The species examined by us may be roughly placed in four groups, thus:

*a.* Median line of belly with a series of enlarged caducous ventral plates, which fall off at certain intervals leaving a naked strip from breast to vent; preopercle strictly entire; gill membranes usually separate, sometimes somewhat connected across the isthmus; ventral fins well separated, the interspace usually not less than the breadth of their base.

ALVORDIUS:*

*b.* Palatine teeth present; dorsal spines 11 to 15; ventral fins widely separated.

*c.* Lower jaw as long as upper; snout very narrow and pointed, especially in the adult; space between mouth and gill cleft about ⅔ length of head; cheeks and opercles scaly; lateral blotches small, quadrate; scales small. PHOXOCEPHALUS, 1418.

*cc.* Lower jaw shorter than upper; snout less pointed; distance from mouth to gill cleft about half head.

*d.* Snout longer than eye; head very large and long, 3½ in length, chiefly naked; scales very small, about 90; 80 pores; sides with oblong blotches. MACROCEPHALUS, 1419.

GROUP A (ventrals widely separated).

Percina rex.
Percina caprodes.
Hadropterus aspro.
Hadropterus peltatus.
Hadropterus ouachitæ.
Hadropterus macrocephalus.
Hadropterus phoxocephalus.
Hadropterus nigrofasciatus.
Hadropterus roanoka.
Hadropterus scierus.
Cottogaster shumardi.
Cottogaster copelandi.
Cottogaster gilberti.
Cottogaster uranidea.
Boleosoma nigrum.
Boleosoma nigrum olmstedi.
Boleosoma camurum.
Crystallaria asprella.
Ioa vitrea.
Ammocrypta pellucida.
Ammocrypta pellucida clara.
Boleosoma podostemone.
Etheostoma swannanoa.
Hypohomus aurantiacus.
Hypohomus cymatotænia.
Hypohomus squamatus.

GROUP B (ventrals well separated, not quite so much so as in A).

Hadropterus evides.
Etheostoma variatum.
Etheostoma zonale.
Ulocentra histrio.
Etheostoma elegans.
Etheostoma blennius.
Ulocentra stigmæa.
Etheostoma thalassinum.
Boleosoma longimanus.

GROUP C (ventrals rather close together).

Psychromaster tuscumbia.
Etheostoma obeyense.
Ulocentra simotera.
Diplesion blennioides.
Microperca punctulata.
Microperca prœliaris.
Etheostoma squamiceps.

GROUP D (ventrals very close together, almost touching).

Etheostoma flabellare.
Etheostoma cœruleum.
Etheostoma lepidum.
Etheostoma cragini.
Etheostoma australe.
Etheostoma whipplii.
Etheostoma jessiæ.
Etheostoma rufilineatum.
Etheostoma camurum.
Etheostoma maculatum.
Etheostoma pottsii.
Copelandellus quiescens.
Boleichthys fusiformis.
Boleichthys fusiformis eos.

In several of these cases, the assignment is almost arbitrary; thus: *Hadropterus nigrofasciatus* has the interspace narrower than in *Hadropterus aspro*, and scarcely wider than in *Hadropterus evides*. *Diplesion blennioides* and *Pyschromaster tuscumbia* might be placed in B as properly as in C. We conclude that while this character may prove useful in classification, we are unable to use it to separate a large group or genus, *Percina*, from the still larger and more heterogeneous group, *Etheostoma*.

*Named for General Benjamin Alvord, U. S. Army, a gentleman interested in natural history, who discovered "*Alvordius maculatus*," at Fort Gratiot on Lake Huron.

*dd.* Snout scarcely longer than eye; head shorter, about 4 in length.

*e.* First dorsal about as high as second; scales rather small.

*f.* Cheeks and opercles entirely naked; sides with dusky shades. MACULATUS, 1420.

*ff.* Cheeks and opercles more or less scaly, the cheeks sometimes naked.

*g.* Scales small, about 60 to 70; 65 to 75 pores; cheeks with small scales; opercle with larger ones; line with rounded confluent blotches. ASPRO, 1421.

*gg.* Scales larger, 50 to 60; 50 to 55 pores.

*h.* Cheeks and opercles each with some large scales. GUNTHERI, 1422.

*hh.* Cheeks naked or with small embedded scales; opercles with some scales.

*i.* Body not very slender, the depth 5½ to 5¾ in length; pectorals shorter than head. PELTATUS, 1423.

*ii.* Body very slender, the depth 6 to 6½ in length; pectorals as long as head. OUACHITÆ, 1424.

*ee.* First dorsal lower than second; scales large, 44 to 50; head chiefly naked; pectorals as long as head; sides barred with deep-blue green in male. ROANOKA, 1425.

ERICOSMA (ἐρ, springtime; κοσμέω, to adorn):

*bb.* Vertebræ about 37; dorsal spines 10 to 12; male with the lower fins tuberculate in spring; gill membranes separate; ventrals not widely separated; scales moderate.

*j.* Cheeks naked; opercles scaly; head heavy; fins large; coloration ornate, the male with much blue-black and orange. EVIDES, 1426.

*aa.* Median line of belly with a series of enlarged and spinous scales, which are persistent, at least posteriorly; ventrals well separated, but the interspace usually less than width of base of fin.

SERRARIA (*serra*, saw):

*k.* Preopercle finely serrated; gill membranes broadly united across isthmus; scales small, about 70.

*l.* Coloration of *Hadropterus aspro*: yellowish, with diffuse, blackish, lateral blotches. depth 5 to 6 in length. SCIERUS, 1427.

HADROPTERUS:

*kk.* Preopercle strictly entire; gill membranes rather narrowly united; scales larger, about 60; body robust, deep.

*m.* Olivaceous, with dark vertical bars; fins high; dorsal rays XII–12; depth 5 in length. NIGROFASCIATUS, 1428.

### Subgenus ALVORDIUS, Girard.

### 1418, HADROPTERUS PHOXOCEPHALUS (Nelson).

Head 3⅔ to 4; depth 5½ to 6; eye 4¼ in head, about equal to snout. D. XI or XII–12 to 14; A. II, 8 or 9; scales 12–80 to 85–16, 66 to 71 pores. Body rather slender, compressed. Head extremely long, narrow, and tapering, the snout very acuminate. Mouth large, the maxillary reaching to the eye; the lower jaw unusually narrow and long, scarcely shorter than upper; distance between mouth and gill cleft ⅔ head. Gill membranes somewhat connected. Cheeks, opercles, and neck with small scales; breast naked; a strong opercular spine; ventral line with small caducous shields; pectoral shorter than head; ventrals widely separated. Skull more elongate than in *H. aspro*, the frontal region very narrow; parietals more convex in cross section than usual in *Hadropterus*, no supraoccipital crest; vertebræ $19 + 20 = 39$. Pyloric cœca 2. Color yellowish brown, but the lateral spots smaller and more numerous than in *H. aspro*, quadrate in form, the hues rather dull; a small blackish spot at each end of the lateral line. Length 6 inches. Ohio to Iowa, south to Kentucky and Oklahoma; in sandy rivers; locally common, especially in Arkansas; a well-marked species, notable for its very slender head. (*φοξός*, tapering; *κεφαλή*, head.)

*Etheostoma phoxocephalum*, NELSON, Bull. Ills. Mus. Nat. Hist., I, 35, 1876, Illinois River and its tributaries. (Coll. Nelson.)

*Alvordius phoxocephalus*, JORDAN & GILBERT, Synopsis, 501, 1883.

*Percina phoxocephala*, BOULENGER, Cat., I, 63.

### 1419. HADROPTERUS MACROCEPHALUS (Cope).

Head 3½ to 4; depth 6 to 7; eye 4½ in head, shorter than snout. D. XIII to XVI-12 to 14; A. II, 9 to 11; scales 11-88 to 90-16, pores 74 to 83. Body elongate; head longer and more slender than in *Hadropterus aspro*; maxillary about reaching pupil, 3¼ in head; nape scaly; cheek naked, or with a few rudimentary scales behind eye; opercle with very small cycloid scales above, rarely quite naked; breast naked; scales on middle line of belly enlarged and caducous. Gill membranes separate. Pectoral 1⅗ in head; anal spines subequal; ventrals well separated. Color light brown; 9 black spots on side, confluent, squarish in form, sharply defined and edged above by a continuous, undulating pale streak from eye to base of caudal; fins, including ventrals, barred; a small but very distinct spot at base of caudal; a median dark shade across spinous dorsal. West slope of the Alleghanies from Pennsylvania southward in mountain streams; rather scarce; known from Youghiogheny River, Foxburg, Pennsylvania; north fork of Holston River, Saltville, Virginia; middle fork of Holston River, Glade Spring, Virginia; Big Sandy, Green, and Cumberland rivers, Kentucky; and Clinch River, Tennessee. A large and interesting darter; found only in clear rivers, not in brooks. (*μακρός*, long; *κεφαλή*, head.)

*Etheostoma macrocephalum*, COPE, Trans. Amer. Philos. Soc., 1866, 400, Youghiogheny River, Pennsylvania; VAILLANT, Recherches, 64, 1873, with plate; JORDAN, Bull. U. S. Fish Comm., VIII, 1888 (1890), 147.

*Alvordius macrocephalus*, JORDAN & GILBERT, Synopsis, 501, 1883.

*Percina macrocephalus*, BOULENGER, Cat., I, 62.

### 1420. HADROPTERUS MACULATUS (Girard).

This species has never been satisfactorily identified since its first description. It seems to be close to *Hadropterus guntheri* and to *Hadropterus aspro*, but is apparently characterized by the naked head. The following is the original description: "Amongst the fishes collected by Major B. Alvord, at Fort Gratiot, Lake Huron, there is a species of *Etheostomid*, the generic character of which reminds us somewhat of those given to the genus *Hadropterus*. The opercle and cheeks, however, are scaleless, as well as the throat, which is minutely prickly. The first dorsal fin is longer and lower than the second, which is equal to the anal. The caudal is emarginated posteriorly. The species itself being yet undescribed, we shall call it *Alvordius maculatus*. The specimen before us measures 2¾ inches. The body is elongated, rather slender, and subfusiform. The head is subconical, entering about 4½ times in the total length. The eye is well developed, its diameter being contained 4 times in the length of the side of the head, once in advance of its anterior rim. The posterior extremity of the maxillary bone extends to a vertical line drawn within the anterior rim of the orbit, not quite in front of the pupil. The lower jaw is somewhat shorter than the upper. The first dorsal fin is much longer and lower than the second, to which it is nearly contiguous. Its upper margin is convex. The second dorsal is lower than high, diminishing gradually backward. The caudal, which forms about the sixth of the total length, is somewhat emarginated posteriorly. The anal is placed opposite the second dorsal, and nearly equal to it in size and shape. The ventrals are sublanceolated and rather short, their posterior extremities being even with those of the pectorals, which are subelliptical in their outline. The formula of the fins reads: D. XIV; A. I, 10; C. 5, 1, 7, 6, 1, 8; V. I, 5; P. 14. The scales are rather small, deeper than long, anteriorly truncated, posteriorly rounded, with radiating furrows upon the anterior sections only, and fine pectination upon the posterior margin. A series of larger scales conspicuously toothed posteriorly, may be observed along the ventral line between the vent and the extremities of the ventrals. The ground color is reddish brown, the dorsal region being tessellated with blackish spots, whilst a series of black patches may be observed on either side, larger and less numerous in the male than in the female. A black streak intersects vertically the eye. The fins in the male are unicolor, except the first dorsal, which is black, spotted at the base. In the female sex the caudal exhibits transverse blackish lines. The inferior regions are unicolor in either sex." (Girard.) (*maculatus*, spotted.)

*Alvordius maculatus*, Girard, Proc. Ac. Nat. Sci. Phila., 1859, 67, Fort Gratiot, Michigan. (Coll. B. Alvord.)

### 1421. HADROPTERUS ASPRO (Cope & Jordan).

(Black-sided Darter.*)

Head 4; depth 5 to 6; eye about equal to snout, 4 in head. D. XIII to XV-11 to 13; A. II, 8 to 10; scales 9-65 to 80-17, pores 63 to 75. Body rather elongate, fusiform, compressed behind. Head moderately elongate less pointed than in some of the species. Mouth moderate, the lower jaw included; maxillary reaching just past the front of the eye. Gill membranes scarcely connected; distance from mouth to gill cleft about half head. Lateral line straight, prolonged forward to the eye. Opercles with rather large scales; cheeks usually covered with very small ones, which are scarcely visible, but rarely or never obsolete; breast naked; nape naked, or more or less scaly; middle line of belly with enlarged caducous scales; body otherwise entirely scaly, the scales small and rough. Pectoral a little shorter than head; ventrals well separated. Skull smoother than in *Percina*, its outline more convex, frontal region very narrow; supraoccipital crest minute. Pyloric cœca 3. Vertebræ $19 + 23 = 42$. Shoulder girdle and pharyngeals as in *Percina*. Coloration straw yellow or greenish, with dark tessellations and marblings above, and about 7 large dark blotches along the sides, which are partly confluent, thus forming a moniliform band; fins barred. Great Lake region to the middle Missouri, and north to Minnesota;* southward through Missouri, Indiana, and Kentucky to Arkansas, especially common in the Ohio Valley; abundant in clear, gravelly streams, not common in small brooks. One of the most curious and elegant of the darters. Its coloration varies much in intensity with differences in surroundings. (*Aspro*, or *Zingel*, a related genus, which this species resembles; from *asper*, rough.)

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* The fine gentleman of the family is the Black-sided Darter (*Hadropterus aspro*). Him we may know by his colors. The ground hue is a salmon yellow; the back is regularly and beautifully marbled with black in a peculiar and handsome pattern. On the sides, from the head to the tail, runs a jet-black band, which is widened at intervals into rounded spots which contrast sharply with the silvery color of the belly; or we may say that on each side is a chain of confluent round black blotches. Sometimes the fishes seem to fade out; these blotches grow pale and no longer meet, but in an instant they may regain their original form and shade. This latter change can be induced by the offer of food, and it is of course due to muscular action on the scales which cover the darker pigment. A male in our aquarium underwent almost instantly an entire change of coloration upon the introduction of a female fish of the same species recognized by him as his affinity. Although the two have been together for some weeks, the novelty has not yet worn off, and although his colors vary much from one hour to another, he has never yet quite reverted to his original hues. The form of the Black-sided Darter is more graceful than that of any other, and his movements have little of that angular jerkiness which characterizes his relatives. The fins of *Hadropterus*, like those of *Percina*, are long and large, the number of dorsal spines being about 14. A notable peculiarity in both species is the presence of a row of shields, or enlarged scales, along the middle line of the abdomen. These may help to protect that part from the friction of the stony bottom. They seem to be shed sometimes, but when or why this happens we do not know. *Hadropterus* delights in clear running water and may be found in most streams south and west of New York. It is especially desirable for aquaria, being hardier than any other fish as pretty, and prettier than any other fish as hardy, and withal with "a way of his own," as an Irish laborer, Barney Mullins, once said to us of Thoreau.—*Jordan & Copeland.*

*Etheostoma blennioides*, KIRTLAND, Journ. Bost. Soc. Nat. Hist., 1839, 340, fig. (but not description); not of RAFINESQUE.

*Alvordius aspro*, COPE & JORDAN, Proc. Ac. Nat. Sci. Phila., 1877, 51, White River, Indianapolis, Indiana, substitute for *Etheostoma blennioides*, of KIRTLAND and AGASSIZ; JORDAN & GILBERT, Synopsis, 501, 1883.

*Percina aspro*, BOULENGER, Cat., I, 59.

### 1422, HADROPTERUS GÜNTHERI (Eigenmann & Eigenmann).

Head $3\frac{4}{5}$ to 4; depth $5\frac{2}{3}$ to 6. D. X–13 or 14; A. II, 9 to 11; scales 5–56 or 57–9, pores 53 to 56. Premaxillaries not protractile; distance from mouth to gill cleft half head; gill membranes scarcely connected; ventral line with the median scales enlarged; lateral line complete; palate with well-developed teeth; preopercle entire; nape and breast (with the exception of the median line) naked; cheeks and opercles each with about 3 series of large scales. A strong opercular spine; pectoral nearly as long as head. Yellowish; back marbled with darker; a lateral series of large dark spots; dark streaks below and before eye; spinous dorsal with a dark spot in front and another behind. Closely related to *Hadropterus ouachitæ*. Souris River, Winnipeg, south to Iowa. (Eigenmann.)

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* Recorded by Dr. Eigenmann from Brandon and Winnipeg in Manitoba. Concerning these specimens, Dr. Boulenger remarks: "The latter specimens have been referred by Prof. Eigenmann to *P. aspro*, from which they differ in the naked cheek (with or without a few embedded scales) and the smaller number of scales in the lateral line. They show the following formula: D. XIII, 12–14; A. II, 9–10; scales $64–72\frac{7}{12–14}$; lateral line 56–62. In the Bull. U. S. Fish Comm., VIII, 1889, p. 113, Professor Jordan says of *P. peltata*: 'General form of *E. aspro*, from which this species scarcely differs exçept in the larger size of the scales.' If so, the Canadian specimens belong to *P. peltata* and not to *P. aspro*. The two species are, however, nearly completely connected, and may ultimately have to be united."

(Named for Dr. Albert C. L. G. Günther, Keeper of the British Museum of Natural History.)

? *Alvordius maculatus*,* Girard, Proc. Ac. Nat. Sci. Phila., 67, 1859, Fort Gratiot, Lake Huron.

*Etheostoma güntheri*, Eigenmann & Eigenmann, Amer. Nat., Nov., 1892, 962, Winnipeg; Souris River, (Coll. Eigenmann); Cedar River, Cedar Rapids, Iowa. (Coll. Meek.)

*Percina guentheri*, Boulenger, Cat., I, 61.

### 1423. HADROPTERUS PELTATUS (Stauffer).

Head 4; depth $5\frac{2}{3}$; eye 4. D. XIII–12; A. II, 10; scales 6–52 to 56–9. General form of *Hadropterus aspro*, but stouter and with larger scales; head rather heavy, the snout bluntish in profile, about as long as eye; lower jaw slightly included, maxillary reaching just past front of eye, its length $3\frac{2}{5}$ in head; gill membranes scarcely connected. Cheek usually wholly naked (*peltatus*), but often with smooth embedded scales (*nevisensis*). Opercle with about 3 small scales above, sometimes naked on one side; nape and breast naked; caducous ventral shields large and few in number. Fins all comparatively low and small; pectoral a little shorter than head, barely reaching tips of ventrals; anal nearly as large as second dorsal, its second spine a little slenderer and longer than first; caudal lunate. Light straw color, the marking all very dark, verging on jet black; back with dark cross blotches and irregular wavy longitudinal markings above lateral line, much as in *H. aspro*; sides with six large conspicuous square black blotches, about as broad as the interspaces and alternating with fainter bars of black, these sometimes coalescing in a dark lateral bar; a faint dusky streak along lateral line; markings sometimes bright (*peltatus*), or obscure and diffuse (*crassus*); top of head black; a black bar below eye; snout and opercle mostly black; nape with a pale spot surrounding a dark one; a dark band in axil and 6 to 8 round spots on back; first dorsal with a submedian black band and some black spots toward tip; second dorsal and caudal obscurely barred; ventrals and pectorals dusky. Southeastern Pennsylvania southward to South Carolina in coastwise streams; locally common; not found west of the Alleghanies. Close to *Hadropterus aspro*, but with the scales always larger. (*peltatus*, shielded.)

*Etheostoma peltatum* (Stauffer MS.), Cope, Proc. Ac. Nat. Sci. Phila., 1864, 233, Conestoga Creek, near Lancaster, Pennsylvania; (Coll. Stauffer); Vaillant, Recherches, 61, 1873, with plates; Jordan, Bull. U. S. Fish Comm., VIII, 1888 (1890), 113.

*Hadropterus maculatus*, Girard, Proc. Ac. Nat. Sci. Phila., 1859, 100, (name preoccupied), tributary of Potomac River, Ann Arundel County, Maryland.

*Etheostoma nevisense*, Cope, Proc. Amer. Philos. Soc. Phila., 1870, 261, Neuse River at the falls, 8 miles east of Raleigh, North Carolina. (Coll. Cope.)

*Alvordius crassus*, Jordan & Brayton, Bull. XII, U. S. Nat. Mus., 12, 1878, Saluda, Ennoree, and Reedy rivers, near Greenville, South Carolina. (Coll. Jordan & Brayton.)

*Alvordius nevisensis, crassus, and variatus*, Jordan & Gilbert, Synopsis, 502 and 503, 1883.

*Percina peltata*, Boulenger, Cat., I, 60.

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* This *Alvordius maculatus* is more likely to be *Hadropterus guntheri* than *H. aspro*, as Girard describes it as having the head scaleless. Perhaps both are varities of one species, to which it may be necessary to add *peltatus* and *ouachitæ* also, and possibly even *aspro*.

### 1424. HADROPTERUS OUACHITÆ (Jordan & Gilbert).

Head 4; depth 6½; eye 3⅘ in head, equal to snout. D. XI or XII–13; A. II, 10; scales 6–52 to 60–10, pores 50 to 58. Body elongate, slender, comparatively little compressed. Head slender, the snout not blunt, the upper profile descending in a long gentle curve. Mouth moderate, narrow, premaxillaries on a level with lower part of orbit, nonprotractile; lower jaw included; gape nearly horizontal; maxillary reaching vertical from front of orbit, its length slightly greater than snout, 3½ in head. Gill membranes scarcely joined across isthmus. Fins of moderate size; longest dorsal spine 2¼ in head, the longest soft ray more than half head; anal spines short and weak, the two nearly equal, their length equaling diameter of orbit; caudal emarginate; pectorals reaching to opposite tips of ventrals, as long as head. Scales moderate, rough; lateral line complete, straight; opercles and nape scaled; cheeks smooth, naked or covered with embedded scales; breast naked; middle of belly naked, or with series of enlarged plates; an enlarged spinous scale between bases of ventral fins. Color olivaceous; back more or less tessellated with dark brownish, the margins of the scales dusky; 5 rather faint dark bars from the back downward and forward to lateral line; the first under front of spinous dorsal and the second under its last rays, the third under middle of soft dorsal and the fourth immediately behind it, the fifth a mere cross blotch on back of tail; on middle of back these bars are narrower than the interspaces, but grow much wider downward; middle of sides with a series of 8 or 9 quadrate dusky blotches, more or less confluent, as in *aspro*; below pale, unmarked; dorsals, caudal, and pectorals more or less evidently barred with light and dark; ventrals and anal unmarked; no red or blue in life. Length 2 inches. Southern Indiana, western Kentucky, and southwest to Arkansas; not rare; known from Patoka River, Indiana (Evermann); lower Green and Obion rivers, Kentucky (Woolman); Black River* and Saline River, Arkansas. Very close to *Hadropterus peltatus*, a little more slender, the pectorals longer, and 4 distinct cross blotches on the back. The scales in both are larger than in *Hadropterus aspro*, which they otherwise much resemble. (Name from the Ouachita River in Arkansas, now usually spelled Washita, from a tributary of which the types were taken.)

*Etheostoma* (*Hadropterus*) *ouachitæ*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 49, 1887, Saline River, Benton, Arkansas, a tributary of the Washita; (Type No. 36449); Coll. Jordan & Meek); Jordan, Bull. U. S. Fish Comm., VIII, 1888 (1890), 164.

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* The following description is taken from a specimen from Black River, Black Rock, Arkansas (Coll. S. E. Meek):

Head 4; depth 6½; eye 3⅘; snout 3⅓; interorbital width 2 in eye. D. X–13; A. II, 10; scales 6–58–8, lateral line complete. Body slender, subterete, rather loosely scaled; breast and nape naked, cheeks and opercles scaly; belly with a naked streak where the plates have fallen off. Head narrow, slender; snout pointed; mouth large, maxillary reaching pupil. Upper jaw with frenum, but scarcely protractile. Gill membranes slightly connected across isthmus. Eye large, a little less than snout; interorbital very narrow. Anal fin large. Color similar to that of *H. aspro*; sides with about 8 very irregular, confluent dark blotches, most distinct on posterior part of body; a dark line forward and a very distinct one downward from the eye, meeting its fellow beneath; 4 broad dark blotches across the back (resembling *Cottogaster uranidea* in this respect), the first at anterior part of spinous dorsal, the second between the dorsals, the third near the middle of soft dorsal, and the fourth just behind the soft dorsal; fins, except ventrals and anal, barred with dark.

### 1425. HADROPTERUS ROANOKA (Jordan & Jenkins).

Head 3¾ to 4; depth 4⅓ to 4¾; eye 4¼ to 4¾ in head, about as long as snout. D. X or XI–11; A. II, 8 or 9; scales 5–48–9, pores 41 to 50. Body decidedly robust, moderately compressed, the back elevated. Head broad, heavy, tapering forward, the snout moderately blunt at tip, then nearly straight from before eye backward to occiput. Premaxillaries not protractile. Maxillary 3⅔ in head, reaching front of pupil. Mouth small, little oblique, low, the lower jaw included all around; teeth rather strong. Cheek scaleless, usually 2 or 3 small scales on upper part of opercle, the head often quite naked; nape and breast naked; middle line of belly with about 8 moderately enlarged scales; preopercle entire; opercular spine moderate; gill membranes very slightly connected; lateral line complete; dorsal fins moderate, contiguous; anal large, its spines large, the first strongest; pectoral about as long as head, reaching beyond ventrals to vent; caudal slightly lunate. Color straw yellow, the males dark green; sides with 10 or 11 vertical cross bars, more or less confluent into a lateral band; in the males these bands are of a deep blue green and vaguely defined; in the females they are distinctly diamond-shaped and confluent along their middle, forming a broad band, with both edges serrate; male with lower parts and paler parts of head bright sulphur yellow; back barred and mottled with dark; nape with a pale spot; head dark blue in males, with a black bar forward and one downward from eye; lips orange. Fins in male nearly plain blue-black; first dorsal with a median band of very bright yellow, its base with a black band, its edge narrowly black; second dorsal and anal faintly barred; some orange yellow on ventrals, anal, and soft dorsal; 2 yellow spots at base of caudal, the upper forming a curved streak above the last of the dark lateral spots. Females paler, yellowish below, the markings black and less diffuse, the second dorsal and caudal sharply barred. Length 2½ inches. Roanoke River, Virginia; common; a beautiful species of the mountain streams.

*Etheostoma roanoka*, JORDAN & JENKINS, Proc. U. S. Nat. Mus., 358, 1888, Roanoke River at Roanoke, Salem, and Alleghany Springs, Virginia. (Type, No. 39866. Coll. Jordan, Evermann, and Jenkins.)

*Percina roanoka*, BOULENGER, Cat., I, 62.

### Subgenus ERICOSMA, Jordan & Copeland.

### 1426. HADROPTERUS EVIDES* (Jordan & Copeland).

Head 4⅓; depth 5⅓; eye rather large, high, 3½ in head. D. XI–10; A. II, 8 or 9; scales 9–52 to 67–9 to 11; vertebræ 18 + 22 = 40. Body moderate, somewhat compressed. Head heavy, the profile rather convex. Mouth moderate, somewhat oblique, the lower jaw included; maxillary reaching front of eye. Cheeks, neck above, and throat naked; opercles with rather larger scales, caducous; ventral plates little enlarged. Fins large; pectorals long; second dorsal lower than anal, but with longer base; ventrals not widely separated. Coloration extremely brilliant; dark olivaceous above, tessellated with dark; sides with about 7 broad transverse bars extending from below the lateral line on one side, across the back, and down the other side; these bars are wider than the eye and are connected along the lateral line by a faint black stripe; in the female these bars are black and the intervening spaces yellowish; in the male the bars are of a dark rich blue green, with metallic luster; the connecting longitudinal line greenish bronze; just above this line is a luminous yellowish streak, and above, in each of the interspaces between the bars, is a bright blotch of bronze-red; blackish green streaks downward and forward from eye; cheeks orange red, the color of iron rust; dorsal fin orange colored, with a bright bronze edge, a blackish spot on the last rays; second dorsal and caudal pale orange; two bright yellowish spots at base of caudal; anal bronze, with a blue-black shading; ventral fins dark blue-black; pectorals faintly orange. Males with the rays of the ventral and anal fins covered with small corneous tubercles, much as in some *Cyprinidæ*. Female and alcoholic specimens show little of the bright colors, although the same pattern is preserved. The spinous dorsal has a dusky spot on its posterior rays, and the fins are destitute of the dark bars found in related species. Length 2 to 3 inches. Indiana, in the Wabash and Maumee basins, west to central Iowa and southward in Arkansas, Kentucky, and Tennessee in the larger, clear streams; especially abundant in the French Broad, the Wabash and in the Ozark region; not found east of the Alleghanies. There is considerable variation in coloration and in size of scales, those from the Tennessee Basin especially having larger scales (52 to 65). One of the most brilliant of all fishes. (*εὐειδής*, comely.)

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* Dr. Boulenger places this well-marked species in the synonymy of "*Percina peltata.*" There is no warrant for this arrangement.

*Alvordius evides*, JORDAN & COPELAND, Proc. Ac. Nat. Sci. Phila., 1877, 51, White River, near Indianapolis, Indiana; (Coll. Jordan & Copeland); JORDAN & GILBERT, Synopsis, 503.

*Etheostoma evides*, JORDAN, Bull. U. S. Fish Comm., VIII, 1889, 53; WOOLMAN, Bull. U. S. Fish Comm., X, 1890, 260.

### Subgenus SERRARIA, Gilbert.

#### 1427. HADROPTERUS SCIERUS, Swain.

Head 4 to 4⅘; depth 5 to 6; eye 4 to 4½ in head, scarcely equal to snout; snout bluntish, 3½ in head. D. XIII–13 or 14; A. II, 9; scales 7–68 to 70–17, pores 64 to 71. Body robust, rather compressed behind. Head rather short. Mouth small, the lower jaw included; maxillary not reaching the eye by about the width of the pupil; preopercle more or less distinctly serrate, especially in the young and in southern specimens. Gill membranes broadly connected. Lateral line straight, complete, not prolonged forward to the eye. Opercle covered with rather large scales; cheeks with slightly smaller ones; a triangular area on the breast, in front of the ventral fins, with embedded scales; breast otherwise almost naked; throat naked; scales persistent, those on middle line of belly little enlarged and not caducous, except a few of the anterior ones, 1 enlarged plate being present between the ventral fins; body otherwise covered with rather small ctenoid scales. Fins all very large;

spinous dorsal separated from the soft dorsal by the length of the snout; outline of the spinous dorsal gently curved, the first spine $\frac{1}{3}$ longer than last spine, and $\frac{2}{3}$ length of middle spine, which is $1\frac{3}{4}$ in head; base of soft dorsal longer than that of anal, its rays of about equal length, $1\frac{3}{5}$ in head; anal about as large as soft dorsal, its spines subequal; ventrals moderately separated, about equal to pectorals, which are $1\frac{1}{4}$ in head. Vertebræ 18 + 22 = 40. Color yellowish olive, everywhere vaguely blotched with black. Top of head, dorsal, anal, and ventral fins entirely black in male, paler in female; base of pectoral and caudal fins, branchiostegal membranes, cheeks, and sides posteriorly blackish; scales everywhere finely punctulate with brown, the sides with a few larger black specks. Length 5 inches. Northern Indiana to Tennessee and Texas, the typical form above described being common in weedy brooks from northern Indiana southward in the Wabash Basin through Kentucky and Tennessee to the Washita and Saline rivers, Arkansas. Strongly resembles *Hadropterus aspro*, but duller in color, and easily distinguished by the united gill membranes and the serrulate preopercle. (*σκιερός*, dusky.)

*Hadropterus scierus*, Swain, Proc. U. S. Nat. Mus., 1883, 252, Bean Blossom Creek, Monroe County, Indiana. (Coll. Jordan & Swain.)

*Etheostoma scierum*, Jordan, Bull. U. S. Fish Comm., VIII, 1888 (1890), 160, 164, and 167; Boulenger, Cat., I, 80.

Represented in streams of Texas by

### 1427a. HADROPTERUS SCIERUS SERRULA, Jordan & Gilbert.

Close to *Hadropterus scierus*, but with smaller scales, 68 to 71 in the lateral line, instead of 64 to 66 as in typical *scierum*. The coloration in *serrula* is paler, with more sharply defined markings, the black blotches on the side being less confluent, and the sides of the belly without dark clouds. Breast naked; the opercle very weakly, but generally distinctly serrulate. From southern Arkansas southward through eastern Texas. Common in sandy streams. (*serrula*, a little saw.)

*Hadropterus scierus serrula*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1886, 16, Red River, Fulton, Arkansas (Type, No. 36481. Coll. Jordan & Swain); Evermann & Kendall, Bull. U. S. Fish Comm., XII, 1892 (1894), 113.

## Subgenus HADROPTERUS, Agassiz.

### 1428. HADROPTERUS NIGROFASCIATUS, Agassiz.

(Crawl-a-bottom.)

Head 4; depth 5; eye moderate, 4 in head, equal to snout. D. XII, 11 or 12; A. II, 9 or 10; scales 7–58–15, pores 55 to 60. Head and body stout and heavy, the body compressed, more robust than in related species. Mouth moderate, the maxillary reaching front of eye; preopercle entire; distance from mouth to gill cleft $\frac{2}{3}$ head. Fins all large. Scales rather large. Pectoral nearly as long as head; ventrals moderately separated; anal spines subequal. Breast usually naked, but sometimes closely scaled; scales on the median line of the belly somewhat enlarged, but the most of them not caducous nor especially spinous. Gill membranes a little connected. Color dark olive above, with blackish markings; sides with vertical bars, somewhat diamond-shaped, but quite narrow; these acute above and below, more or less confluent along the middle, about 12 in number; the bands dark greenish, varying to jet black, most distinct near the middle of the body and broadest behind; inner half of each of the vertical fins black; outer half more or less speckled and barred; top of head black, a black band through eye and snout, and a dark vertical shade below the eye; a small black spot between 2 smaller ones at base of caudal fin; no red nor blue. Length 6 inches. South Carolina to Louisiana in the larger clear streams; common in the Alabama Basin; one of the largest of the darters, its form heavy, more like that of a typical perch. (*niger*, black; *fasciatus*, banded.)

*Hadropterus nigrofasciatus*, AGASSIZ, Amer. Journ. Sci. and Arts, XVII, 1854, 305, Mobile, Alabama; JORDAN & GILBERT, Synopsis, 506.

*Plesioperca anceps*, VAILLANT, Recherches sur Etheostom., 37, plate 1, fig. 3, 1873; no locality given.

*Alvordius spillmani*, HAY, Proc. U. S. Nat. Mus., 1880, 491, Chickasawha River, Mississippi. (Type, No. 27432. Coll. Hay.)

*Etheostoma nigrofasciatum*, VAILLANT, Recherches, 69, 1873; BOULENGER, Cat., I, 80.

## 467. HYPOHOMUS, Cope.

*Hypohomus*, COPE, Proc. Amer. Phil. Soc. Phila., 1870, 449, (*aurantiacus*).

*Swainia*, JORDAN & EVERMANN, new subgenus, (*squamatus*).

This genus contains darters closely allied both to *Hadropterus* and to *Etheostoma* (*Nothonotus*). From the former they are separated by the non-differentiation of the ventral scales, the belly being covered with small, persistent scales like those on the sides. From *Etheostoma*, *Hypohomus* is distinguished chiefly by the larger anal fin, more depressed cranium, and more separated ventrals. The relation in both cases is very close. Species of large size and usually showy coloration. (ὑτώ, below; ὁμός, uniform.)

SWAINIA*:
  *a.* Gill membranes broadly united across the isthmus; scales very small; snout long and slender, the mouth long and narrow.
    *b.* Color olivaceous, with dark lateral blotches; a black humeral scale; fins with orange; head $3\frac{5}{7}$ in length; depth $5\frac{1}{2}$; cheek and opercles scaly. SQUAMATUS, 1429.
HYPOHOMUS:
  *aa.* Gill membranes scarcely connected; snout moderately produced.
    *c.* Opercles and breast scaly.
      *d.* Scales very small, about 85; dorsal rays XV, 15; color yellow, with dark lateral shades. AURANTIACUS, 1430.
      *dd.* Scales moderate, about 66; dorsal rays about XIII, 13; color greenish, with a dark wavy lateral band, bordered above and below by pale; a dark spot at base of caudal. CYMATOTÆNIA, 1431.
    *cc.* Opercles and breast naked; cheeks nearly so; dorsal rays about XII, 12; color brilliant olive, with dark cross bars, the interspaces red in the male.
      *e.* Scales about 74; lateral line complete. NIANGUÆ, 1432.
      *ee.* Scales about 60; lateral line incomplete. SPILOTUS, 1433.

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*Named for Dr. Joseph Swain, President of the University of Indiana, and discoverer of the typical species.

### Subgenus SWAINIA, Jordan & Evermann.

### 1429. HYPOHOMUS SQUAMATUS (Gilbert & Swain).

Head $3\frac{5}{7}$; depth $5\frac{1}{2}$. D. XIV–13; A. II, 10; scales 10–82–18. Body elongate, the sides and caudal peduncle compressed; back elevated, the profile forming a slight angle at occiput; head very long and slender, with a long acuminate snout, as in *Hadropterus phoxocephalus*, which this species somewhat resembles in appearance. Cleft of mouth long and narrow, the lower jaw included in closed mouth; maxillary reaching vertical from front of orbit, its length equaling that of snout, $3\frac{1}{2}$ times in head; upper jaw not protractile. Bands of teeth very wide, the outer premaxillary series enlarged. Vomerine patch well developed. Eye moderate, $1\frac{2}{5}$ in snout, $4\frac{3}{4}$ in head to end of opercular spine, $2\frac{1}{2}$ times the furrowed interorbital width. Preopercular margin strictly entire. Gill membranes widely united across isthmus. Spinous dorsal long and low, spines from the third to the tenth subequal in length, those anteriorly and posteriorly gradually shortened; longest spine $\frac{1}{3}$ length of head; spinous and soft dorsals well separated; base of soft dorsal equaling $\frac{1}{2}$ the distance from its origin to front of spinous dorsal; anal shorter than soft dorsal, but higher and inserted more anteriorly; anal spines strong, the first slightly the longer, about equaling length of snout; highest anal ray nearly half length of head; caudal emarginate, the lobes rounded, $1\frac{4}{5}$ in head; pectorals equal to length of head behind front of eye; ventrals $1\frac{3}{5}$ in head. Body covered with very small scales, uniform in size, and completely investing the ventral region, which is without series of enlarged scutes; cheeks, breast, and nuchal region covered with still finer scales having entire edges, and the opercle with larger spinous scales; interopercle and part of subopercle naked; an enlarged black humeral scale. Colors in life: Yellowish olive, with about 10 broad dusky bars across the back, and an equal number of dusky blotches along lateral line; a conspicuous black humeral spot; a broad black line forward from eye to snout, and a narrower line backward from eye to upper preopercular margin; opercle and occiput largely dusky; a diffuse dusky blotch at base of tail, with a small round, jet-black spot behind it; spinous dorsal translucent, with a broad subterminal brownish-orange band; soft dorsal and caudal barred with dusky and orange-yellow; pectorals slightly reddish; ventrals translucent. Length 5 inches. Upper Tennessee River Basin; known from the Watauga and French Broad rivers; rare; a large and interesting species, remarkable for its long and slender head; perhaps the type of a distinct genus. (*squamatus*, scaly, the scales being small and close-set.)

*Etheostoma* (*Hadropterus*) *squamatus*, Gilbert & Swain, Proc. U. S. Nat. Mus., 1887, 50, French Broad River, at mouth of Wolf Creek, Tennessee. (Type, No. 36652. Coll. Gilbert & Swain); Jordan, Bull. U. S. Fish Comm., VIII, 1888 (1890), 147, 153.

*Etheostoma squamatum*, Boulenger, Cat., I, 84.

### Subgenus HYPOHOMUS, Cope.

### 1430. HYPOHOMUS AURANTIACUS (Cope).

Head $4\frac{1}{4}$; depth 6; eye 4 in head; snout $3\frac{3}{4}$. D. XV–15; A. II, 11; scales about 14–100–15, 85 pores. Body elongate, somewhat compressed;

head moderate, snout decurved; mouth nearly horizontal, lower jaw slightly included; premaxillaries not protractile; maxillary reaching past front of orbit; gill membranes slightly connected; width of interorbital space about 5 in head. Cheeks, opercles, and nape covered with fine scales; breast naked; scales very small, firm, and even, strongly ctenoid; lateral line nearly straight, complete. Dorsal fins long, well separated, low, longest spines less than half length of head; anal higher; pectorals long, 1⅕ in head; caudal truncate. Color in life olive, tinged with orange; a black lateral band of confluent black blotches; chin and throat deep orange; deep orange on front of spinous dorsal, shading to yellow behind; orange on front of pectoral; a round yellow spot above each interspace in lateral band; a row of small brown spots on each side of back nearer base of dorsal fin than to lateral line, these ceasing under soft dorsal; top of head dark. Length 4 to 6 inches. Upper Tennessee Basin, rather rare, in swift waters; a beautiful species; known from the North Fork of Holston, Clinch, Watauga, and French Broad rivers. (*aurantiacus*, orange colored.)

*Cottogaster aurantiacus*, Cope, Journ. Ac. Nat. Sci. Phila., 1869, 211, North Fork of Holston River, Saltville, Virginia, (Coll. Cope).

*Etheostoma aurantiacum*, Vaillant, Recherches, 67, 1873; Jordan, Bull. U. S. Fish Comm., viii, 1888 (1890), 147; Boulenger, Cat., i, 67.

*Hadropterus aurantiacus*, Jordan & Gilbert, Synopsis, 505, 1883; Bean, Proc. U. S. Nat. Mus., 1885, 165.

### 1431. HYPOHOMUS CYMATOTÆNIA (Gilbert & Meek).

Head 4 to 4¼; depth 5; eye large, 4 in head, about equaling snout; D. XII to XIV–12 to 14; A. II, 10. Scales 7–64 to 70–12, pores 60 to 63. Body robust, comparatively little compressed, the ventral region very prominent, rounded, the dorsal region scarcely elevated; dorsal and ventral outlines converging rapidly toward caudal peduncle, which is very narrow and expands abruptly behind to form a broad basis for the caudal fin. Head short, tapering rapidly forward, the snout not blunt, short and slender. Mouth small, oblique, the lower jaw included; maxillary nearly reaching vertical from front of orbit, about 4½ in head. Teeth in very narrow cardiform bands, the outer series in both jaws rather conspicuously enlarged. Cheeks, opercles, nape, and breast covered with large scales, those on cheeks smaller than the others. Preopercular margin entire. Gill membranes narrowly joined across isthmus, the union being in most cases hardly perceptible, but in one specimen examined quite broad. Spinous dorsal rather short and high, the first spine but little shorter than the second; anterior spines highest, the outline of the fin thence declined; highest spine equaling half the length of the head; soft dorsal small, quadrate, as long as high, its base but little more than half that of spinous dorsal, its longest ray 1¾ in head; first anal spine very strong and robust, much stronger than any of dorsal spines, or than the second anal spine, its length equaling distance from snout to center of pupil, equaling or slightly exceeding that of second anal spine; anal larger than second dorsal, its base slightly longer, and the rays higher, the longest ray 1½ to

1⅜ in head; caudal slightly emarginate; pectorals short, not reaching tips of ventrals, the two about equal in length, equaling head behind nostrils. Body covered with large, rough scales, everywhere spinous, but with a tendency to smoothness on the breast; ventral region completely and uniformly scaled, without median series of enlarged plates, two or three of which only are visible between the ventrals. Colors in life: Above and on sides greenish, made very dark by fine, close-set, punctulations; two pairs of light streaks along sides, narrower than interspaces, becoming yellowish in spirits; the upper pair from the nape running along each side of dorsal, inclosing between them a dusky streak occupying median line of back; the lower pair from above opercles running in a wavy course above lateral line to upper caudal lobe; below this and bounded by it, occupying the middle of the sides, is a broad dusky moniliform band; lower part of sides and ventral region light olive, dusted sparsely with rather coarse black specks; a small jet-black spot at base of caudal; a broad black bar (sometimes obscure) on head from snout through eye across upper part of cheeks to opercular spine; sometimes a series of small black cross blotches on median dorsal line; fins translucent, barred with dark lines. Length 4 or 5 inches. Western Kentucky and southern Missouri, in clear, cold streams; not very common; one of the most beautiful species. (*κῦμα*, wave; *ταινία*, ribbon or stripe.)

*Etheostoma (Hadropterus) cymatotænia*, GILBERT & MEEK, Proc. U. S. Nat. Mus., 1887, 51; Niangua River and Osage Fork of the Gasconade, near Marshfield, Missouri; Sac River, near Greenfield, Missouri; (Type, Nos. 36215, 36308, 38260. Coll. Gilbert & Meek); WOOLMAN, Bull. U. S. Fish Comm., x, 1890 (1892), 260.

*Etheostoma cymatotenia*, BOULENGER, Cat., I, 67.

### 1432. HYPOHOMUS NIANGUÆ (Gilbert & Meek).

Head 3⅘; depth 5⅔ to 6. D. XI or XII–13 or 14; A. II, 11 or 12; scales 11–74–16. Body elongate, terete, the sides somewhat compressed, becoming more so posteriorly; back elevated, the profile descending gently in an unbroken line from front of dorsal to tip of snout. Head very long and slender, much as in *H. macrocephalus* and *H. phoxocephalus*; the snout comparatively deep and narrow, abruptly rounded vertically at tip. Mouth large, the cleft wide and slightly oblique, the maxillary reaching beyond front of orbit, its length equaling distance from snout to front of pupil, 3½ in head (the latter measured in this description to end of opercular spine). Outer series of premaxillary teeth somewhat enlarged, the bands all broad. Eye slightly less than snout, 5½ in head to end of opercular spine; interorbital space convex transversely, its width about ⅗ diameter of eye. Cheeks perfectly smooth, with a few scattered, embedded cycloid scales; opercles and breast strictly naked; nape and ventral region closely scaled. Preopercular margin entire. Gill membranes scarcely joined across the isthmus. Spinous dorsal short and high, the first spine much shorter than the second, the seventh and eighth about equal, the longest 2¼ in head; soft dorsal high, its base 1⅓ in that of spinous dorsal, the longest ray 1⅘ in head; anal similar to second dorsal, but smaller; first anal spine short, the second but little longer, its length equaling that of snout; caudal wide, truncate behind, slightly emarginate when fin is not spread; pectorals equaling distance from front of orbit to tip of opercular spine, the tips of pectorals and ventrals reaching about the same vertical; ventrals 1½ or 1⅔ in head. Scales on body of moderate size, becoming larger and less closely imbricated posteriorly, those on nape and along base of dorsal anteriorly little imbricated, roundish, without spinous points, partially embedded in the skin; ventral region uniformly scaled, without naked strip or series of caducous plates; no enlarged scale between bases of ventral fins; head and breast naked, excepting a few embedded scales below and behind eye. Color olivaceous, the back with 8 to 10 dusky cross bars wider than the interspaces; these dorsal bars usually continuous with an equal number on middle of sides, the latter terminating below lateral line in V-shaped prolongations, much like those in *Diplesion blennioides*. In one specimen examined (adult male) the first 2 bars are partially confluent on sides, the anterior one including the axil and ending in a black spot below pectorals, the second encircling body behind ventral fins; bars behind front of anal in this specimen also completely encircling body; back and sides marked with many small, bright, carmine-red spots, irregularly disposed in the light interspaces; in the male specimen examined by us they are much more numerous, those on hinder part of body confluent, forming narrow bars, 1 down the middle of each light space; a dark streak forward and 1 backward from eye, none downward; opercle and top of head dusky; spinous dorsal dusky, the base marked with fine red spots, the fin broadly margined with a bright carmine band; soft dorsal barred with alternating series of dark and of reddish spots; caudal with wide bars of dark and red; a pair of small jet-black spots on caudal peduncle at base of median caudal rays; anal dusky at base; pectorals and ventrals light orange, indistinctly barred with dusky. Length 4 inches. Niangua River, in the Ozark region of southern Missouri; scarce; not seen elsewhere. A singularly beautiful fish.

*Etheostoma* (*Hadropterus*) *nianguæ*, GILBERT & MEEK, Proc. U. S. Nat. Mus., 1887, 52, Niangua River, near Marshfield, Missouri (Type, No. 36214. Coll. Gilbert & Meek); MEEK, Bull. U. S. Fish Comm., IX, 1889 (1891), 125.
*Etheostoma nianguæ*, BOULENGER, Cat., I, 68.

### 1433. HYPOHOMUS SPILOTUS (Gilbert).

Head 3½ to 3¾; depth 5¼ to 6⅓; eye 5 in head in specimens 2 to 3 inches long. D. X or XI–12 or 13; A. II, 10 or 11. Scales 8–58 to 60, the pores absent on the posterior 5 to 13 scales, and occasionally on single scales more anteriorly. Color in life olive green above, light below; back with 8 dark cross bars formed of dusky mottlings; continuous with these, or in other cases alternating with them, are 8 V-shaped markings on middle of sides; sides and above spotted, with reddish orange occupying the light interspaces; a narrow black bar from above opercular angle, through eye, encircling the snout; pectorals and ventrals translucent, tinged with light orange; dorsal translucent, the rays speckled; spinous dorsal with a narrow red margin, terminating posteriorly in a bright orange-red spot, in advance of which is a large black blotch; a black humeral spot; 2 jet-black spots at base of caudal, more or less confluent into 1. In all other respects this agrees with the description of typical *nianguæ*. Length 2¾ inches. Kentucky River; apparently rare. Close to *Hadropterus nianguæ*, but the scales much larger and the lateral line incomplete. (*σπιλοτός*, spotted.)

*Etheostoma nianguæ spilotum*, Gilbert, Proc. U. S. Nat. Mus., 1887, 53, Sturgeon Creek, a tributary of the Kentucky River, near Travellers Rest, Owsley County, Kentucky. (Type, No. 38319. Coll. Gilbert); Woolman, Bull. U. S. Fish Comm., x, 1890 (1892), 280, pl. 51, fig. 3.

### 468. COTTOGASTER, Putnam.

*Cottogaster*, Putnam, Bull. Mus. Comp. Zoöl., 5, 1863, (*tessellatum*, Thompson, not of De Kay = *copelandi*).

*Imostoma*, Jordan, Proc. Ac. Nat. Sci. Phila., 1877, 49, (*shumardi*).

*Rheocrypta*, Jordan, Bull. U. S. Nat. Mus., x, 9, 1877, (*copelandi*).

Body rather robust, little compressed. Head moderate, bluntish. Mouth moderate or small, the lower jaw included; premaxillaries protractile or occasionally (in *shumardi*) joined by a narrow frenum to the frontal region; maxillary not adherent to the preorbital. Teeth on vomer. Gill membranes nearly separate. Scales ctenoid; the middle line of the belly anteriorly naked or with caducous scales; lateral line continuous. Dorsal fins large, the second usually smaller than the first and smaller than the anal. Anal spines two, the first the longer. Pyloric cœca 3; vertebræ 18 + 20 = 38 (*copelandi*). Skull short, the frontal region not very narrow; parietals little convex transversely; sutures distinct. No supraoccipital crest. Coloration not brilliant. Size moderate. (*κόττος*, sculpin; *γαστήρ*, belly.)

Cottogaster:

- *a.* Median line of belly with a series of more or less enlarged caducous spinous scales; cheeks and breast mostly naked.
  - *b.* Dorsal rays X or XI–13; back with four broad black cross bands. uranidea, 1434.
  - *bb.* Dorsal rays XI–10 or 11; back tessellated; sides pale, with a series of black blotches; a small ink-like speck at base of caudal. copelandi, 1435.

Imostoma (*εἰμι*, to move; *στόμα*, mouth):

- *aa.* Median line of belly naked anteriorly, with ordinary scales posteriorly; cheeks mostly scaly; premaxillaries sometimes with a frenum.
  - *c.* Dorsal rays X or XI–13 to 15; scales about 56; sides with diffuse dusky blotches. shumardi, 1436.

#### Subgenus COTTOGASTER.

#### 1434. COTTOGASTER URANIDEA (Jordan & Gilbert).

Head 3½ to 3⅔; depth 5⅔; eye 3¾ in head; snout 3¾. D. X or XI–13; A. II, 10 or 11; scales 6–48 to 56–x. Form moderately elongate, terete, very little compressed; upper profile gently arched, the lower almost straight; caudal peduncle short and very slender; upper profile of head descending in a long gentle curve to the sharp snout. Premaxillaries always protractile, the fold very narrow. Eye equaling length of snout, 3¾ in head, nearly twice interorbital width in a specimen 2 inches long. Opercular spine well developed; preopercular margin entire. Parietal region rather broad, depressed, the bones rugose. Gill membranes very slightly joined at base. Cheeks mostly naked; opercles closely scaled. Breast naked, or with a few scattered scales. Paired fins rather small, the vertical fins long but rather high; membrane of first dorsal not joining base of second; longest dorsal spine about equaling distance from tip of snout to middle of orbit; soft rays half as long as head; caudal fin deeply emarginate; anal spines very short, about equal in size, as long as diameter of orbit; soft rays of anal high, the fin rather longer than second dorsal; pectorals and ventrals short, reaching about the same vertical, not nearly to vent; length of pectorals nearly equal to head. Scales of moderate size; nape completely invested; a wide naked strip on each side of median line of belly, the latter containing a single series of thin, elongate plates, weakly spinous on posterior margins, these probably caducous; lateral line complete, parallel with outline of back. Color greenish olive, rendered dusky on upper parts by black specks which become large and very conspicuous on top of head, opercles, and sides of snout; four conspicuous dark cross bars, narrower than interspaces, downward and forward from back to lateral line; the first from anterior dorsal spines, the second from space between dorsals, the third from posterior half of soft dorsal, and the fourth from caudal peduncle; a series of about 11 dusky blotches on sides immediately below lateral line; a black bar before, one below and one behind eye, the one below eye very distinct; dorsals, pectorals, and caudal barred with light and dark; ventrals and anal plain. In life the colors similar, there being no distinct blue, red, or green. Lower Wabash basin (Evermann) to southern Missouri, south through Arkansas and Alabama to the Escambia; mostly in sandy lowland streams. A strikingly colored species.* (*Uranidea*, the miller's thumb, or blob, now called *Cottus*; *οὐρανός*, sky; *εἶδος*, looking.)

*Etheostoma* (*Cottogaster*) *uranidea*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1887, 48, Washita River, Arkadelphia, Arkansas; (Type, No. 36413. Coll. Jordan & Gilbert); Jordan, Bull. U. S. Fish Comm., VIII, 1888 (1890), 164.

### 1435. COTTOGASTER COPELANDI (Jordan).

Head 3¾ to 4¼; depth 5½ to 6½; eye large, 3⅓ to 3⅔ in head. D. X to XII-10 to 12; A. II, 8 or 9; scales 6–44 to 56–8. Body rather slender and elongate. Head rather large and long, somewhat narrowed, resembling that of *Boleosoma*. Mouth small, horizontal, subinferior. Cheeks naked; opercles and neck each with a few scales; throat naked; ventral plates well developed; scales moderate, strongly ctenoid. Pectoral as long as head. Color brownish olive; a series of rather small, horizontally-oblong, black blotches along the lateral line, forming an interrupted lateral band; back tessellated; blackish streaks forward and downward from eye; ventral fins dusky in the male; vertical fins with dusky specks; a small ink-like speck at base of caudal persistent in most specimens; a black spot on anterior rays of spinous dorsal. Length 2½ to 3 inches. Great Lake region, from Lake Champlain to Lake Huron and south to the Black

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* Improperly placed in the synonymy of *Cottogaster shumardi* by Dr. Boulenger.

Warrior, westward to Missouri and through the Ozark region, where it is abundant, as also throughout Central Indiana, in clear brooks. A plainly colored and very variable species, the eastern form, subspecies *putnami*, usually with larger scales,* (44 to 48), the typical *copelandi* having usually 53 to 56. *C. putnami* inhabits the Great Lake region from Lake Huron to Lake Champlain. (Named for its discoverer, Herbert Edson Copeland, an enthusiastic student of these fishes; a most active and well-equipped naturalist, whose early death at Indianapolis in 1876, deprived American ichthyology of one of its ablest workers.)

*Boleosoma tessellatum*, THOMPSON, Appendix Hist. Vermont, 5, 1853, Lake Champlain; not of DEKAY.

*Rheocrypta copelandi*, JORDAN, Bull. X, U. S. Nat. Mus., 9, 1877, White River, near Indianapolis, Indiana; (Type, No. 20143. Coll. Jordan); scales 56.

*Cottogaster putnami*, JORDAN & GILBERT, Synopsis, 498, 1883, Westport Brook, Essex County, New York; Lake Champlain; (name a substitute for *Boleosoma tessellatum*, THOMPSON); specimens with scales 44 to 48.

*Boleosoma copelandi*, BOULENGER, Cat., I, 91.

### Subgenus IMOSTOMA, Jordan.

### 1436. COTTOGASTER SHUMARDI (Girard).

Head 3⅗ to 4; depth 5 to 5⅓; eye large, 3½ in head, as long as snout. D. IX to XI-13 to 15; A. II, 10 to 12; scales 6-48 to 60-11. Body stout, heavy forward, compressed behind. Head broad and thick. Mouth large and broad, the lower jaw wide, a little shorter than the upper; maxillary reaching to the eye. Premaxillaries usually protractile, but a narrow frenum sometimes present. Cheeks, opercles, and neck usually scaly; the cheeks rarely naked; chest naked; belly naked anteriorly, scaly for a distance in front of the vent; scales rather large. Dorsal fins large, the first larger than the second, which is smaller than the anal, though longer; the 2 dorsal fins well separated; anal fin large, very deep, in some male specimens reaching to the caudal; anal spines strong, the first the larger; pectoral nearly as long as head. Color dark, densely but vaguely blotched with darker; sides with 8 to 10 obscure blotches, the anterior ones bar-like; a large black spot on base of spinous dorsal behind, and a small one in front; second dorsal, caudal, and pectorals barred; a very strong black suborbital bar, and a faint dark line along muzzle. Length 3 inches. Michigan to Ohio, Indiana, and Illinois, and southward to Kentucky and Arkansas; common in the lower Wabash

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*Concerning the relation of these forms, Mr. Woolman remarks: "*Etheostoma copelandi* and *E. putnami* are closely allied, and may be identical, the chief differences occurring in the number of spines in the dorsal and anal fins and in the size of the scales. *E. copelandi* has dorsal XI-10; anal II-9; lateral line 56. *E. putnami* has dorsal X-11; anal II-8; lateral line 44. In 13 specimens from this locality the dorsal is X-11, X-12, XI-11, XI-10, X-11, XI-12, X-11, X-12, X-12, X-12, X-12, X-11, X-12: anal II-9, II-8, II-9, II-9, II-8, II-8, II-8, II-9, II-9; lateral line 51, 48, 51, 49, 52, 51, 50, 48, 51, 48, 50, 50, 54. In these specimens the lateral line does not go as high as the average given for *E. copelandi*, nor as low as in *E. putnami*, while the number of fin rays seems to indicate nothing. I was also unable to find any constant difference in the relative proportion of head and depth."

To this Dr. Gilbert adds: "Specimens of this species recently collected by Dr. J. A. Henshall at Put-in-Bay (Lake Erie), Ohio, have scales varying from 47 to 52; others from New Harmony, Indiana (collected by Prof. Evermann), vary from 46 to 51. In the Alabama specimens the lateral line averages 53. I am thus unable to longer distinguish *putnami* (characterized by its larger scales) from *copelandi*."

River; very variable; inhabits rivers rather than brooks. (Named for its discoverer, Dr. George C. Shumard, surgeon of the U. S. Pacific R. R. Survey.)

*Hadropterus shumardi*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 100, Arkansas River, near Fort Smith, Arkansas.

*Etheostoma wrighti*, McCORMICK, Bull. Oberlin College Lab., No. 2, 30, 1891, near Oberlin, Lorain County, Ohio; specimen with a frenum to upper jaw. (Coll. L. M. McCormick.)

*Etheostoma schumardi*, VAILLANT, Recherches, 73, 1873.

*Imostoma shumardi*, JORDAN & GILBERT, Synopsis, 498, 1883.

*Boleosoma shumardi*, BOULENGER, Cat., I, 92.

## 469. ULOCENTRA, Jordan.

*Ulocentra*, JORDAN, Man. Vert. E. U. S., Ed. 2, 223, 1878, (*atripinnis*).

Body moderately elongate, little compressed. Head short, thick, with tumid cheeks. Mouth small, horizontal, the lower jaw included. Premaxillaries protractile, little movable, sometimes with a narrow, mesial frenum in some species; maxillary movable, not joined to the preorbital except at its root; vomerine teeth present, small. Gill membranes narrowly or broadly connected. Scales moderate; the belly scaled like the sides, with no ventral plates. Lateral line complete or incomplete. First dorsal with about 12 spines; anal smaller than second dorsal, with 2 well-developed spines, the first the longer. Ventrals not widely separated. Vertebræ (*simotera*) $15+23=38$. Skull not very narrow anteriorly; parietal region rather depressed, not strongly convex transversely. Frontal region much broader than in *Diplesion*. Supraoccipital crest small. Small species, often highly colored, intermediate between *Boleosoma* and *Diplesion*. (οὖλος, complete; κέντρον, spine; the chief character separating the genus from *Boleosoma*.)

- *a.* Gill membranes narrowly connected; cheeks and opercles usually scaly; body slender; scales large.
  - *b.* Lateral line incomplete; coloration olivaceous, tessellated with darker; scales about 46. STIGMÆA, 1437.
  - *bb.* Lateral line complete; scales about 55; pectorals as long as head. GILBERTI, 1438.
- *aa.* Gill membranes broadly united.
  - *c.* Lateral line complete or nearly so.
    - *d.* Opercles naked or nearly so.
      - *e.* Spinous dorsal longer than soft dorsal; pectorals as long as head; sides with green spots; scales about 47. VERECUNDA, 1439.
      - *ee.* Spinous dorsal not longer than soft; pectoral longer than head; sides much variegated; scales about 52. HISTRIO, 1440.
    - *dd.* Opercles scaled; pectoral longer than head; snout blunt; scales about 50; sides with dark green quadrate blotches. SIMOTERA, 1441.
  - *cc.* Lateral line incomplete; cheeks and opercles naked; anal rays II, 6; red, with dark markings. PHLOX, 1442.

### 1437. ULOCENTRA STIGMÆA (Jordan).

(SPECK.)

Head 4¼; depth 5. D. X to XIII–12; A. II, 7; scales 5–46 to 55–10, pores 35, more or less. Body slender, formed as in *Boleosoma*. Head narrow and thin, the snout somewhat pointed, obliquely truncate in profile.

Mouth narrow, horizontal, subinferior, its cleft nearly reaching eye; premaxillaries little protractile, sometimes with a narrow frenum. Lateral line extending to opposite middle of second dorsal; scales rather large; opercles, cheeks, and neck scaly; breast naked. Gill membranes not very broadly joined; opercular spine sharp. Fins rather large; caudal emarginate. Olivaceous, tessellated, and speckled above; sides with about 8 W-shaped dark green blotches below the lateral line and various duller ones above; upper parts in the larger specimens sprinkled with small orange spots, which are more conspicuous after death, when the green has faded; fins mottled; spinous dorsal with a band of orange red above, and 1 or 2 narrow dark ones below it; a dark stripe forward and another downward from eye. Length 2½ inches. Tennessee and Arkansas to Georgia and Louisiana; rather common in the ponds and streams of the pine woods; a small variable species. (*στιγμαῖος*, speckled, from *στιγμή*, speck.)

*Boleosoma stigmæum*, Jordan, Ann. Lyc. Nat. Hist. N. Y., 1876, 311, small tributaries of the Etowah and Oostenaula rivers, near Rome, Georgia. (Coll. Jordan & Gilbert.)

*Pœcilichthys saxatilis*,* Hay, Proc. U. S. Nat. Mus., 1880, 495, a rocky and sandy stream flowing into the Chickasawha River at Enterprise, Mississippi. (Type, No. 27433. Coll. O. P. Hay.)

*Etheostoma stigmæum*, Gilbert, Bull. U. S. Fish Comm., ix, 1889 (1891), 150.

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*Concerning the form called *saxatilis*, Dr. Gilbert has the following:

"Head 3¾ to 4; depth 6. D. XI to XIII–11 to 12; A. II, 9; scales 50 to 55, 5 longitudinal series between lateral line and base of spinous dorsal. Numerous specimens from various localities enable us to contribute the following points to our knowledge of this species: With much the habit of *E. olmstedi*, but the snout slender and sharp, with gently decurved profile and the mouth terminal, nearly horizontal; lower jaw included; maxillary extending scarcely beyond vertical from front of eye. Preopercle entire; opercular spine developed. Gill membranes evidently but rather narrowly united across isthmus. Pectorals reaching somewhat beyond ventrals, about as long as head, not nearly reaching vent; ventrals not extending ⅔ distance to front of anal, equaling distance from snout to preopercle; dorsal fins well separated, the interval between them equaling ⅔ diameter of orbit; dorsal spines very slender and fragile, the longest equaling longest soft ray and half length of head; anal spines slender, about equal in length, the anterior the stronger, ⅓ length of head; soft anal rays equal half distance from snout to base of pectorals; caudal shallowy lunate. Scales strongly ctenoid, uniformly covering body except breast, those on the nape smaller; opercles and upper portion of cheeks closely scaled; head otherwise naked; no enlarged black humeral scale. Lateral line reaching about to end of soft dorsal, on 30 to 45 scales. Color in life: Olivaceous, with six dark cross bars on back and with dark tessellations, which follow the same pattern as in *E. olmstedi*; those on upper parts light brownish red, instead of dusky; the M-shaped marks along sides dusky, serving, in the brighter specimens only, as the starting points for light-blue bands which more or less completely encircle belly and caudal peduncle; no other bright markings; a narrow dark streak from eye to snout; an indistinct dark streak below and a black spot behind eye; dorsals and caudal inconspicuously barred; a pair of minute jet-black spots at base of median caudal rays, more conspicuous in the young; opercle dusky. This species has undoubtedly a very wide distribution. Originally described by Professor Hay from the Chickasawha River, it was during the summer of 1884 found to be abundant in tributaries of the Clinch River near Clinton, Tennessee, in the Black Warrior River at Morris, and at Tuscaloosa, Alabama and in the Saline and Washita rivers in Arkansas. Our specimens have been compared with the original types, with which they agree in all respects. The frenum joining the premaxillary to the forehead is very narrow and easily ruptured, the upper jaw then appearing protractile. Occasionally the fold is continuous, no frenum being present, the species varying in this respect like *E. simoterum*."

In a later paper Dr. Gilbert adds: "This species is widely distributed throughout the basins of the Cumberland, Tennessee, Escambia, Alabama, and Pascagoula rivers, and will doubtless be found in other Gulf rivers. It has also been taken in Arkansas. Comparison of *saxatile* with the type of *stigmæum*, and with additional material from the Coosa River has shown their identity. Specimens are in the present collection from Cypress Creek and Big Nance."

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*Etheostoma davisoni*,† HAY, Proc. U. S. Nat. Mus., 1885, 554, Yellow River, near Chaffin, Santa Rosa County, Florida (Coll. Mann & Davison); anal rays II, 6.
*Ulocentra stigmæa*, JORDAN & GILBERT, Synopsis, 515, 1883; BOULENGER, Cat., I, 99.
*Ulocentra davisonii*, BOULENGER, Cat., I, 99.

### 1438. ULOCENTRA GILBERTI, Evermann & Thoburn, new species.

Head $4\frac{1}{2}$; depth 6; eye 3 in head, longer than snout. D. IX–12; A. II, 9; scales 5–54 to 57–x. Body slender, fusiform, little compressed; the upper profile descending in a gentle, regular curve from front of dorsal to tip of snout, which is below the axis of the body. Mouth small, horizontal, the lower jaw included; maxillary reaching vertical from front of orbit, its length equal to diameter of eye; premaxillaries protractile. Interorbital space $\frac{2}{3}$ diameter of eye. Gill membrane narrowly joined, free from isthmus. Lateral line continuous, nearly straight, continued forward to eye. Opercle and upper part of cheeks with scales similar to those on body; breast naked; scales on median line of belly similar to the others. Fins moderate, the pectoral reaching to tip of ventral and $\frac{2}{5}$ distance to anal, equal to length of head; anal rather small. Color in alcohol: Yellowish with dark tessellations above; 8 to 10 oblong blotches along the sides, with smaller blotches between and partly confluent with them; the coloration much as in *Cottogaster copelandi*; upper fins barred. Three specimens from Clinch River, at Walker's Ford, near Tazewell, Tennessee, the longest 2 inches in length. (Type, No. 47531. Coll. Evermann, Scovell, and Gurley.) (Named for Dr. Charles Henry Gilbert.)

### 1439. ULOCENTRA VERECUNDA (Jordan & Evermann).

Head $4\frac{1}{2}$; depth $4\frac{1}{2}$; eye large, longer than snout, $3\frac{1}{4}$ in head. D. XI, 11; A. II, 7; scales 6–47–9. Form of head and body much as in *Pœcilichthys zonalis*, the body subfusiform, little compressed, the back somewhat elevated. Head small; snout short, very convex in profile. Mouth small, inferior, horizontal; premaxillaries protractile, but with traces of an obsolete mesial frenum; maxillary extending to just beyond front of eye, $3\frac{3}{4}$ in head. Gill membranes broadly united; preopercle entire; cheeks, opercles, and nape scaly; breast naked; lateral line complete. Fins all very low; dorsal fins scarcely joined; caudal slightly lunate; pectorals as long as head, reaching tips of ventrals, not to vent. Color in spirits: Greenish yellow, much mottled with darker green; 6 or 7 distinct quadrate green spots along lateral line; traces of 3 dark spots in a vertical row at base of caudal; a dark bar below and before eye; top of head dark; ventrals and anal plain; other fins barred with dark olive; spinous dorsal with orange in front and orange spots on its last rays, tip of last spines dark. Length 2⅛ inches. Tributaries of Holston River, Virginia; rare. (*verecundus*, modest.)

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* *Ulocentra davisoni* (Hay).

Head $4\frac{1}{5}$; depth $6\frac{1}{2}$; eye 3; snout $1\frac{1}{3}$ in eye. D. IX–10, well separated; A. II, 6; scales 5–50–7, pores developed on about 30. Interorbital space narrow. Mouth large, horizontal, terminal, the maxillary extending to a perpendicular from pupil; cleft of mouth $\frac{1}{4}$ head; jaws about equal; premaxillaries freely protractile. Cheeks and opercles densely scaled; breast naked; opercular spine well developed; gill membranes narrowly connected; vomerine teeth apparently present. Base of spinous dorsal $4\frac{1}{2}$ in length of body, its height 7; base of soft dorsal shorter, 7 in length of body, its height about the same. Anal spines well developed, the first the stronger. The pectorals reach to vertical of eighth dorsal spine, the ventrals falling short of tips of pectorals. Caudal peduncle compressed, tapering gradually to caudal fin. General color olivaceous; many scales, each with a dark blotch, these uniting to form zigzag and W-shaped markings, especially above the lateral line; sides with about 10 larger and nearly square spots, the largest on caudal peduncle; belly and chest under a lens are seen to be thickly sprinkled with black dots; a black streak downward from eye and another forward to snout; fins dusky; both dorsals with rows of dusky spots between the rays; caudal barred. One specimen known, Yellow River, near Chaffin, Santa Rosa County, Florida. This is probably identical with *Ulocentra stigmæa*.

*Etheostoma verecundum*, JORDAN & EVERMANN, Proc. U. S. Nat. Mus., 1888, 360, Middle Fork of the Holston River, about 5 miles south of Glade Spring, Virginia. (Type, No. 39862. Coll. Jordan, Evermann, and Jenkins.)

*Ulocentra verecunda*, BOULENGER, Cat., I, 98.

### 1440. ULOCENTRA HISTRIO (Jordan & Gilbert).

Head 4 to 4¼; depth 5 to 5½; eye 3 in head; scales 5½–50 to 54–X. D. X–13; A. II, 7. In form much resembling *Pœcilichthys zonalis*, but the body slenderer and less compressed, and the anterior profile of head more declivitous, the mouth being on a level with lower portion of base of pectorals. Mouth small, horizontal, subinferior, the lower jaw included; maxillary reaching vertical from front of pupil, 3⅗ in head. Eye rather large, high up on sides of head, its diameter much greater than length of snout. Interorbital width half vertical diameter of orbit; parietal region narrow, smooth, rather strongly arched. Opercular spine little developed. Gill membranes broadly joined across the isthmus. Premaxillaries technically protractile, the upper lip everywhere separated by a fold from the skin of the forehead; they are, however, very little movable. Vertical fins small, the paired fins greatly developed; spinous and soft dorsals separate, nearly equal in height and extent; the longest dorsal spine half length of head, the spines all slender and weak; first anal spine longer and stronger than the second, slightly longer than snout; caudal fin emarginate, less than length of head; pectorals much longer than head, reaching beyond tips of ventrals to vent, their length nearly ⅓ that of body; ventrals about as long as head. Scales ctenoid; lateral line complete, not decurved; head naked, or with a few scales on opercles; nape completely scaled; breast and a long strip behind ventral fins naked, only the posterior half of ventral region scaled over; no enlarged humeral scale. Color: Body very dark green; back with 7 light cross bars, usually very distinct; ventral region light, the lower half of sides marked with light and dark greenish, these markings showing a tendency to form bars, usually alternating with those on back; top of head dark, the sides light greenish; a broad dark bar from eye to tip of snout, 1 below eye, and a broad dusky area covering parts of opercle, preopercle, and cheek; a dark bar in front of pectoral fin and several transverse series of dark spots on under side of head; fins all conspicuously marked with broad bars of light and dusky greenish; a black humeral spot; females show traces of this plan of coloration, but are more uniformly dusky greenish, the lighter marking much less conspicuous. Length 2 inches; a small, odd looking little fish. Southern

Indiana and southwestward to Arkansas;[*] known from the lower Wabash and tributaries (Evermann), Green River, Kentucky, and Black, Poteau, and Washita rivers, Arkansas; locally common. (*histrio*, a harlequin.)

*Etheostoma* (*Ulocentra*) *histrio*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1887, 47, Poteau River, near Hackett City, Arkansas; Saline River at Benton, and Washita River at Arkadelphia, Arkansas. (Type, Nos. 36386, 36409, 36448. Coll. Jordan & Gilbert.)

*Etheostoma histrio*, JORDAN, Bull. U. S. Fish Comm., VIII, 1888, 164.

*Ulocentra histrio*, BOULENGER, Cat., I, 98.

### 1441. ULOCENTRA SIMOTERA (Cope).

Head 4 to 4⅔; depth 4 to 5; eye 3½ in head; D. X to XII–10 or 11; A. II, 7; scales 6–48 to 52–11. Body short and rather deep. Head small; the snout very obtuse with strongly curved profile, almost as blunt as in *Diplesion blennioides.* Cheeks, opercles, and breast naked or partly scaly. Dorsal fins well separated; pectoral a little longer than head; lateral line complete. In life pale green, the dark markings green; various scales on back bronze-red in center, the neighboring scales light yellow, the bronze markings forming very irregular streaks; belly pale yellow, more or less flushed with bright orange; spinous dorsal pale at base, then a black streak, then pale, each membrane with an orange spot throughout the pale streak, the first two spots of a brilliant scarlet; edge of the fin snuffy brown; soft dorsal with the rays pale yellowish, the membranes spotted with bronze brown, a black spot at base of each ray; caudal yellowish, with three wavy black bars; anal and ventrals pale yellowish; pectorals yellowish, faintly barred; head with various green markings; a dark stripe downward and one forward from the eye. Length 3 inches. An elegant and peculiar species, carrying to an extreme the gobioid appearance of these fishes. Western Virginia, eastern Kentucky and Tennessee, in the basins of the Green, Cumberland, and Tennesee rivers, southward through Alabama to the Escambia River; very abundant in clear rocky or sandy streams; one of the handsomest of the small darters. (*σιμοτέρα*, comparative of *σιμός*, snub-nosed.)

*Hyostoma simoterum*, COPE, Journ. Ac. Nat. Sci. Phila., 1868, 215, Holston River and its tributaries; VAILLANT, Recherches, 100, 1873, with plates.

*Ulocentra simotera*, JORDAN & GILBERT, Synopsis, 495, 1883; BOULENGER, Cat., I, 97.

*Arlina atripinnis*,[†] JORDAN, Bull. X, U. S. Nat. Mus., 10, 1877, tributary of the Cumberland River, near Nashville, Tennessee. (Type, No. 20433. Coll. A. Winchell.)

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[*] The following description is taken from the specimens from Black River, Black Rock, Arkansas, belonging to *Ulocentra histrio*, (Coll. S. E. Meek):

Head 4½; depth 5¼; eye 4; snout 3½; D. IX–9; A. II, 7; scales 6–56–7, lateral line complete; cheeks and opercles nearly naked, a few scales on their upper parts; nape scaled; breast and anterior portion of belly naked. Body rather robust, similar in form to *Pœcilichthys zonalis.* Head heavy; snout short, sharply decurved; mouth small, horizontal, the lower jaw included; upper jaw with a slight frenum, premaxillaries slightly protractile; gill membranes broadly united; teeth in jaws well developed. Fins rather high; pectorals large, their tips reaching past tips of ventrals. Color dark olivaceous, much mottled with darker; six dark dorsal blotches; top of head and base of caudal black; spinous dorsal with a broad dark margin across top of spines and downward on first membrane; all the other fins irregularly barred and dotted with black or dark brown; a dark vertical bar above base of ventral; a series of dark spots on postocular and a dark line downward from eye; snout and lower parts of head with some spots.

[†] The description of this form is substantially as follows:

*Ulocentra atripinnis* (Jordan).—Head 4⅛; depth 4½. D. XII–10 or 11; A. II, 7. Body rather short, somewhat compressed behind. Head extremely short and deep, the snout very short and abruptly rounded, as in *Ulocentra simwtera.* Eye large. Gill membranes broadly united. Mouth

### 1442. ULOCENTRA PHLOX (Cope).

D. X-12; A. II, 5; scales 5–52-8. Body rather stout. Head compressed. Mouth terminal, the premaxillaries freely protractile; opercular spine strong. Cheeks and opercles naked. Breast and neck scaleless or nearly so. Scales rather large, the belly scaled like the sides. Gill membranes not described. Lateral line straight, reaching middle of second dorsal. Vermilion red, with faint, small, brown dorsal spots; a series of similar blue spots along the lateral line. Spinous dorsal with a dark blue border; second dorsal with a dark shade; caudal cross-barred. Anal fin small, other fins large. Length 2 inches. Trinity River, Texas. (Cope.) Not seen by us. (*φλόξ*, flame.)

*Boleosoma phlox*, Cope, Bull. xvii, U. S. Nat. Mus., 1880, 30, Trinity River, Fort Worth, Texas. (Coll. Cope.)

*Ulocentra phlox*, Jordan & Gilbert, Synopsis, 495, 1883; Boulenger, Cat., i, 90.

## 470. DIPLESION, Rafinesque.

*Diplesion*, Rafinesque, Ichth. Ohiensis, 37, 1820, (*blennioides*).

*Hyostoma*, Agassiz, Amer. Journ. Sci. and Arts, 1854, 305, (*newmani*).

Body rather elongate, subterete. Head very short and blunt, with tumid cheeks; the profile very convex. Mouth small, inferior, horizontal. Premaxillaries protractile, little movable, joined to the forehead mesially by a slight frenum; maxillary not protractile, adnate for most of its length to the fleshy skin of the preorbital; lower jaw very short; teeth in jaws strong; no teeth on vomer or palatines. Gill membranes broadly connected. Gill rakers very short. Scales moderate, rough. Lateral line complete; no enlarged ventral plates. Dorsal fins large, the spinous dorsal longer and lower than the second, of about 13 spines; anal smaller than second dorsal, with 2 strong spines. Ventrals moderately separated; pectorals long, symmetrical. Vertebræ (*blennioides*) $19 + 23 = 42$. Pyloric cœca 4. Frontal region of skull very narrow; ethmoid region abruptly decurved. Parietal region moderately convex (less so than in *Etheostoma*, more so than in *Boleosoma*); no supraoccipital crest. Coloration largely green. (*δίς*, two; *πληςίον*, near; dorsal fin nearly divided in two.)

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small, with equal jaws. Cheeks and opercles scaly; the cheek scales small and closely set; a triangular series of scales on temporal region; throat smooth; neck above closely scaled; belly closely scaled. Fins large; spinous dorsal high, the second still higher, but smaller than the first, its base about equal to the length of the head; dorsal fius contiguous, slightly connected. Color olivaceous; head above entirely black; back with 8 dark cross bars; about 11 bar-like blotches, somewhat indistinct, arranged along the lateral line; fins chiefly black; membranes of the second dorsal and ventral fins entirely black, that of the spinous dorsal with a broad black horizontal bar at base, above which are numerous distinct black oblique streaks; anal with a broad black bar; caudal and pectoral fins largely dusky. Females and young probably paler. Scales 7–58–8. Length 2½ inches. Cumberland River. It is probably identical with *Ulocentra simotera*. (*ater*, black; *pinna*, fin.)

### 1443. DIPLESION BLENNIOIDES* (Rafinesque).

(GREEN-SIDED DARTER.)

Head 4⅓ to 4⅔; depth 4¾ to 6. D. XII to XIV–12 to 15; A. II, 8 or 9; scales 6–58 to 78–14. Body stout, elongate, little compressed; profile very convex. Eyes large, 3½ in head, high up and close together; a longitudinal furrow between the eyes. Mouth small, horizontal, quite inferior; upper jaw concealed in a furrow under the snout. Opercular spine strong; distance from mouth to gill cleft ⅔ head. Scales moderate; those on the belly large, not caducous; cheeks with fine scales; opercles with large ones; neck scaly; chest naked. Anal papilla very large. Anal spines strong; caudal fin emarginate; lower rays of the pectorals, and the rays of the ventrals and anal enlarged and fleshy in the males. Pectoral longer than head, of 15 rays. Vertebræ 23+21=44. Color olive green, tessellated above; sides with about 8 double transverse bars, each pair forming a Y-shaped figure; these are sometimes joined above, forming a sort of wavy lateral band; in life these markings are of a clear deep green; sides sprinkled with orange dots; head with olive stripes and the usual dark bars; first dorsal dark orange brown at base, blue above, becoming pale at tip; second dorsal and anal of a rich blue green, with some reddish; caudal greenish, faintly barred; young and female specimens are more or less dull, but the pattern is peculiar. Length 3 to 5 inches. Pennsylvania to South Dakota and Kansas and south to the lower Alabama basin; one of the handsomest and most abundant of the darters; in clear brooks. (*Blennius*, blenny; *εἶδος*, likeness.)

*Etheostoma* (*Diplesion*) *blennioides*, RAFINESQUE, Journ. de Physique, 419, 1819, Ohio River; VAILLANT, Recherches, 57, 1873.

*Hyostoma newmani*, AGASSIZ, Amer. Journ. Sci. and Arts, 1854, 305, vicinity of Huntsville, Alabama. (Coll. Dr. Newman.)

*Pileoma cymatogramma*, ABBOTT, Proc. Ac. Nat. Sci. Phila., 1860, 327, no locality.

*Hyostoma blennioperca*, COPE, Journ. Ac. Nat. Sci. Phila., 1868, 215, tributaries of the Kanawha and Holston rivers.

*Diplesium blennioides*, JORDAN & GILBERT, Synopsis, 497, 1883; BOULENGER, Cat., I, 100.

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*One of the most simply beautiful of all fishes is the Green-sided Darter (*Diplesion blennioides*). He is not like the *Etheostoma cæruleum*, an animated rainbow, but he has the beauty of green grass, wild violets, and mossy logs. As we watch him in the water, with his bright blended colors and gentle ways, once more, with Old Izaak, "we sit on cowslip banks, hear the birds sing, and possess ourselves in as much quietness as the silent silver streams which we see glide so quietly by us." During the ordinary business of the year, *Diplesion*, like most sensible fishes and men, dresses plainly. It is not easy to get time for contemplation when the streams are low and food is scarce. Besides, a plain coat may ward off danger as well as facilitate attack. At all times, however, he may be known by these marks: The fins are all large; the back is covered with zigzag markings, while on the lower part of the sides are 8 or 9 W-shaped olive spots; these are more or less connected above, and sometimes form a wavy line. The eyes are prominent; the snout is very short and rounded; while the little inferior mouth is puckered up as if for saying "prunes and prisms, prunes and prisms." But when the first blue birds give warning by their shivering and bodiless notes that spring is coming, then *Diplesion* puts on his wedding clothes and becomes, in fact, the Green-sided Darter. The dorsal fins become of a bright grass green, with a scarlet band at the base of each; the broad anal has a tinge of the deepest emerald; while every spot and line upon the side has turned from an undefined olive to a deep rich green, such as is scarcely found elsewhere in the animal world excepting on the heads of frogs. The same tint shines out on the branching rays of the caudal fin, and may be seen struggling through the white of the belly. The blotches nearest the middle of the back become black, and thickly sprinkled everywhere are little shiny specks of clear bronze orange. In the aquarium *Diplesion* is shy and retiring, too much of a fine lady to scramble for angleworms or to snap at the "bass feed." She is usually hidden among the plants or curled up under an arch of stones or in a geode.—(Jordan & Copeland.)

## 471. BOLEOSOMA, De Kay.

### (TESSELLATED DARTERS.)

*Boleosoma*, DE KAY, New York Fauna: Fishes, 20, 1842, (*tessellatum = olmstedi*).
*Arlina*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 64, (*effulgens*).
*Estrella*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 65, (*atromaculata*).
*Vaillantia*, JORDAN, Bull. U. S. Nat. Mus., XII, 89, 1878, (*camurum*).

Body moderately elongate, fusiform, but slightly translucent. Head small, narrowed forward, the profile convex. Mouth small, horizontal, the lower jaw included; premaxillary protractile. Maxillaries not adnate to preorbital. Vomerine teeth present. Scales large; lateral line continuous or interrupted behind; belly with ordinary scales. Gill membranes broadly or narrowly connected. Dorsal spines usually 9, very slender and flexible; soft dorsal much larger than anal; anal normally with a single, short, slender spine, the first soft ray simple, but articulate; ventrals well separated; vertebræ (*B. nigrum*) $15+22=37$. Pyloric cœca 3 to 6. Frontal region of skull very short and narrow; parietal region flattish above; no supraoccipital crest. Coloration olivaceous and speckled, the males with inky black in spring; no red or blue. Size small. Very active little fishes; abounding among weeds in clear streams. (*βολίς*, arrow, dart; *σῶμα*, body.)

BOLEOSOMA:

*a.* Lateral line complete or very nearly so; pyloric cœca 6.

*b.* Pectorals very long, ⅓ to ½ longer than head; opercles scaly; gill membranes somewhat connected.

*c.* Snout about as long as eye; profile steep and nearly straight; scales about 43. LONGIMANUS, 1444.

*cc.* Snout shorter than eye; profile rounded; mouth small, inferior; scales about 37. PODOSTEMONE, 1445.

*bb.* Pectorals moderate, about as long as head; body and fins speckled; male with the head black in spring.

*d.* Head more or less scaly; dorsal rays usually IX–12 to 14; scales 44 to 55. NIGRUM, 1446.

*dd.* Head wholly naked; dorsal rays usually VIII–10; scales 45 to 50. SUSANÆ, 1447.

VAILLANTIA*:

*aa.* Lateral line ceasing near middle of body; pyloric cœca 3; cheeks and opercles scaly; breast usually so; head speckled above. D. IX or X–10 or 11; A. I, 7 or I, 8; scales about 56. CAMURUM, 1448.

### 1444. BOLEOSOMA LONGIMANUS (Jordan).

Head 4⅖; depth 5. D. X–13; A. I, 8; scales 5–44–7. Body moderately elongate, not much compressed; head rather long, somewhat blunt anteriorly, convex above the eyes; profile of the snout steep and nearly straight; premaxillaries protractile; lower jaw included; maxillaries reaching front of orbit, about as long as eye, which is 4 in head, and about as long as snout; teeth rather strong; gill membranes a little connected. Lateral line complete; scales rather large; belly naked anteriorly, with ordinary scales posteriorly. Cheeks naked; opercles with some scales; nape and breast naked. Pectorals very long, reaching front of anal, about 1½ times

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*Named for Léon Vaillant, ichthyologist of the museum at Paris, author of a most excellent monograph of the *Etheostomidæ*.

as long as head; ventrals long, but not reaching tips of pectorals nor front of anal; dorsal spines high, the longest $1\frac{1}{5}$ in head; soft dorsal very high, $1\frac{1}{10}$ in head; anal smaller than soft dorsal; anal spine short, the first ray longer than the spine, simple, but articulate toward the tip; caudal lunate. Color in spirits: Straw color, many scales on the back darker; 10 dark spots on sides, rather irregular and small; 1 at base of caudal and 1 on front of opercle; back with 5 or 6 dark cross blotches. Both dorsals with dark spots; caudal and pectoral somewhat barred; 3 or 4 dark bars only on caudal; ventrals and anal plain; a stripe forward from eye, but only a very faint dark shade below eye; a little black spot on base of pectoral above; sometimes faint dark dashes on lower part of side, alternating with the dark blotches. In life this species is clear green, with markings of darker green or black. Length $2\frac{1}{2}$ inches. Basin of James River, Virginia; recorded from North River at Loch Laird, Virginia; Buffalo Creek near Lexington, Virginia, and Elk Creek near Natural Bridge, Virginia. An active species living among rocks; locally abundant. (*longus*, long; *manus*, hand.)

*Etheostoma longimana*, Jordan, Proc. Ac. Nat. Sci. Phila., 1888, 179, tributary of James River, Virginia; (Type, No. 24619, Mus. Comp. Zoöl., 8 specimens); Jordan, Proc., U. S. Nat. Mus., 1888, 361.
*Boleosoma longimanus*, Boulenger, Cat., I, 95.

### 1445. BOLEOSOMA PODOSTEMONE (Jordan & Jenkins).

Head $4\frac{2}{5}$; depth $5\frac{2}{3}$; eye $3\frac{3}{4}$ in head, a little longer than snout. D. X–13; A. I, 8; scales 4–35–6. Body rather stout, somewhat compressed, the back elevated. Head short, rather bluntly rounded in profile, the rather wide, blunt snout overhanging the small inferior mouth. Upper jaw protractile; maxillary short, freely movable, just reaching front of eye, and scarcely as long as eye; mouth very small, inferior, contracted; teeth small; gill membranes broadly united. Cheeks, nape, and breast naked; opercles with a few large scales; preopercle entire; middle line of belly naked anteriorly with ordinary scales behind; lateral line complete. Dorsal fins moderate; anal fin lower and smaller than soft dorsal; anal spine short; first anal ray simple, a little longer than the spine and articulate toward tip; candal truncate; pectorals rather long, $\frac{1}{4}$ longer than head, reaching beyond ventrals to vent. Color, light yellowish green, with 7 or 8 small dark quadrate spots along side; 5 or 6 larger ones along back; scales of back mostly with dark centers; a dark bar below eye; a little spot behind eye; a dark opercular bar and a dark bar before and behind pectorals; lower side of head with some dark spots; pectorals, both dorsals and caudal, with cross bands of dark olive spots; dorsal in life also spotted with brownish red; caudal also with a subterminal dark band; ventrals and anal nearly plain. Length 2 inches. Roanoke River Basin; locally abundant in very clear streams, living almost exclusively in the river weed *Podostemon ceratophyllum* (Michaux), whence the specific name.

*Etheostoma podostemone*, Jordan & Jenkins, Proc. U. S. Nat. Mus., 1888, 359, Roanoke River at Roanoke, Salem, and Alleghany Springs, Virginia. (Type, No. 39863. Coll. Jordan, Evermann, and Jenkins.)
*Boleosoma podostemone*, Boulenger, Cat., I, 95.

### 1446. BOLEOSOMA NIGRUM (Rafinesque).

(Johnny Darter.*)

Head 3¾ to 4½; depth 5 to 6; eye 3⅔ to 4 in head, equal to or a little longer than snout. D. IX-12 to 14 (VIII to X-10 to 14); A. I, 7 to 9; scales 5-44 to 55-9, rarely 35 to 40. Body fusiform, slender, little compressed. Head conical, moderate, the snout somewhat decurved. Mouth small, lower jaw included. Cheeks and breast naked (specimens occasionally found with these regions closely scaly); opercles scaly; space before dorsal mostly scaled. Opercular spine strong; space between mouth and gill cleft about half head. Fins high; pectoral about as long as head; dorsals about equal in height, the spinous a little longer. Anal small, its spine short and weak; caudal truncate. Coloration pale olivaceous; back much tessellated with brown; sides with numerous small **W**-shaped blotches; head speckled above, mostly black in the males; a black line forward from eye and sometimes a line downward also; fins barred; males in the spring blackish anteriorly, often almost entirely jet black. Tubes of the lateral line sometimes obsolete on the last 4 or 5 scales. Length 2 to 2½ inches. Eastern United States, almost everywhere, especially northward, the typical form (*nigrum*) throughout the Ohio Valley, Great Lake region, and Upper Mississippi west to Colorado and north to Manitoba;† very abundant in most streams, especially small ones, among

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*We never grew tired of watching the little Johnny (*Boleosoma nigrum*, Rafinesque). Although our earliest aquarium friend—and the very first specimen showed us by a rapid ascent of the river weed how "a Johnny could climb trees"—he has still many resources which we have never learned. Whenever we try to catch him with the hand we begin with all the uncertainty that characterized our first attempts, even if we have him in a two-quart pail. We may know him by his short fins, his first dorsal having but 9 spines, and by the absence of all color save a soft yellowish brown, which is freckled with darker markings. The dark brown on the sides is arranged in 7 or 8 **W**-shaped marks, below which are a few flecks of the same color. Covering the sides of the back are the wavy markings and dark specks, which have given him the name of the "Tessellated Darter," but *Boleosoma* is a braver name and we even prefer "Boly" for short. In the spring the males have the head jet-black, and this dark color often extends on the back part of the body so that the fish looks as if he had been taken by the tail and dipped into a bottle of ink. But with the end of the nuptial season this color disappears, and the fish regains his normal strawy hue. The head in *Boleosoma* resembles that of *Diplesion*, but the habit of leaning forward over a stone, resting on the front fins, gives a physiognomy even more frog-like. His actions are, however, rather bird-like, for he will strike attitudes like a tufted titmouse, and he flies rather than swims through the water. He will, with much perseverance, push his body between a plant and the side of the aquarium and balance himself on the slender stem. Crouching cat-like before a snail shell, he will snap off the horns which the unlucky owner pushes timidly out. But he is often less dainty, and, seizing the animal by the head, he dashes the shell against the glass or a stone until he pulls the body out or breaks the shell.—*Jordan & Copeland.*

†Specimens obtained by Mr. Woolman from Big Stone Lake, Minnesota, and which may represent a tangible variety, are described as follows:

Head 3½; depth 5⅖; eye 4½ (4 without flap), equaling snout. D. VIII-12; A. I, 8; scales 4-49-5. Resembling the variety *olmstedi* in the high fins and slender body; head moderate; caudal peduncle long and slender; mouth large, nearly horizontal; premaxillaries protractile, maxillary reaching vertical of pupil; gill membranes scarcely connected. Cheeks naked or nearly so; opercles, nape, and breast scaled; belly with ordinary scales; lateral line complete, slightly arched in anterior portion. Dorsal fin high, the longest spine about 1¾ in head, the soft portion a little higher; anal rays about 2 in head; anal fin smaller than soft dorsal, its base 1⅖ in that of soft dorsal; pectoral long, as long as head, almost reaching anal fin; ventrals short, 1⅓ in pectoral. Color of male, in alcohol, dusky, with 10 or 11 darker vertical bars extending from median line of back to below lateral line, the anterior ones narrow, those on posterior part of body broader; the spaces between these bars with small dark punctulations; top and sides of head profusely punctulate, a dark suborbital spot; spinous dorsal black on membrane connecting first 2 or 3 spines, rest of spinous part punctate and edged with black; a small black spot on posterior part; soft dorsal more or less mottled; caudal paler, some black on tip and edges; anal profusely covered with fine dark points, thickest on edge; ventrals blue black; pectorals pale. Length 2 inches. Known only from Big Stone Lake, Ortonville, Minnesota.

gravel and weeds. The typical form (*nigrum*) has the lateral line slightly interrupted behind, the dorsal rays usually IX–12, and the fins rather low. (*niger*, black.)

*Etheostoma nigrum*, RAFINESQUE, Ichth. Ohiensis, 37, 1820, Green River, Kentucky.

*Boleosoma maculatum*, AGASSIZ, Lake Superior, 305, 1850, Lake Superior. (Coll. Agassiz).

*Boleosoma olmstedi brevipinnis*, COPE, Journ. Ac. Nat. Sci. Phila., 1868, 214, Kiskiminitas River, Pennsylvania.

*Boleosoma mutatum*, VAILLANT, Recherches sur Etheostomatidæ, 88, 1873; substitute for *maculatum* of AGASSIZ, changed on account of the prior *maculatum* of KIRTLAND.

*Pœcilichthys beani*, JORDAN, Proc. U. S. Nat. Mus., 479, 1884, Tabo Creek, Lafayette County, Missouri. (Type, No. 35754.)

*Boleosoma nigrum*, BOULENGER, Cat., I, 93.

Represented Northeastward by

### 1446a. BOLEOSOMA NIGRUM OLMSTEDI (Storer).

(TESSELLATED DARTER; GRAND ORANCHEE.)

Head 4; depth 5½. D. IX–14 or 15; A. I, 9; scales 47 to 52. Body slender, little compressed, with long caudal peduncle. Head slender, rather pointed. Cheeks and opercles scaly; space before dorsal and breast usually naked, sometimes closely scaled. Fins very high, pectorals reaching past tips of ventrals. Coloration olivaceous, tessellated above; sides with blotches and zigzag markings; fins speckled or somewhat barred; head not speckled, dusky in males; usually a black stripe forward from the eye and another downward. Length 3½ inches. Lake Ontario to Massachusetts, south to Virginia, chiefly coastwise and east of the Alleghanies; probably intergrades with *Boleosoma nigrum*, but generally the dorsal is longer in *olmstedi*, the fin higher, and the head more scaly. (Named for Charles H. Olmsted, an early student of the fishes of the Connecticut River.)

*Etheostoma olmstedi*, STORER, Journ. Bost. Soc. Nat. Hist., 1841, 61, pl. 5, fig. 2, Hartford, Connecticut. (Coll. Chas. H. Olmsted).

*Perca minima*, HALDEMAN, Journ. Ac. Nat. Sci. Phila., VIII, 1842, 330, Susquehanna River.

*Boleosoma tessellatum*, DE KAY, New York Fauna: Fishes, 20, pl. 20, fig. 57, 1842, "most of the fresh-water streams of New York;" no definite locality given.

*Etheostoma atromaculata*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 66, Potomac River, vicinity of Washington, D. C.; a slight variety with nape and breast closely scaled; this form found also in Cayuga Lake, New York.

? *Boleosoma æsopus*,* COPE, Proc. Am. Philos. Soc., 1870, 270, Loyalsoc Creek, a tributary of the Alleghany River in Pennsylvania.

*Boleosoma olmstedi*, JORDAN & GILBERT, Synopsis, 492, 1883.

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* *Boleosoma æsopus* (Cope): D. VII–14; A. 10; scales 5–47–8. Body stout, the back rather elevated; the caudal peduncle somewhat contracted; muzzle somewhat decurved; mouth terminal. Dorsal fins much elevated. Color light brown, with 6 small dark dorsal spots, and 10 similar small spots along the dorsal line; a bar around muzzle and one below eye. Length 2¼ inches. Loyalsoc Creek. (Cope.) One specimen known, probably an accidental variation of *Boleosoma olmstedi*.

Represented southeastward by

### 1446b. BOLEOSOMA NIGRUM EFFULGENS (Girard).

Head 4⅕; depth 6¼; eye 3¾ in head. D. IX–13; A. I, 9; scales 5–40 to 49–6. Body rather slender; caudal peduncle not contracted; opercular spines rudimental; muzzle abruptly decurved. Opercles scaly; cheeks, nape, and breast naked; sometimes a few scales on cheek. Fins very high; caudal very much rounded; ventrals reaching anal; pectorals still longer. In the males the dorsal is extremely high, the membranes largely black, the rays spotted with white; seven dark cross blotches on back; 8 faint dark marks on side, the intervening spaces metallic green in life; a small spot at base of caudal; caudal with white specks. Length 2½ inches. Maryland to North Carolina. (*effulgens*, brilliant.)

*Arlina effulgens*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 64, brooks and streams flowing into the Potomac River; VAILLANT, Recherches, 142, 1873.

*Boleosoma effulgens*, JORDAN & GILBERT, Synopsis, 493, 1883.

Represented in streams of Virginia by

### 1446c. BOLEOSOMA NIGRUM VEXILLARE (Jordan).

Head 4; depth 4⅔. D. VIII or IX–10 to 12; A. I, 7; scales 4–35 to 47–6. Body rather short and stout; caudal peduncle not contracted; opercular spine moderately developed; space in front of dorsal fin naked; muzzle moderately decurved; eye moderate. Second dorsal very high, higher than long; pectorals and ventrals long, nearly reaching anal. Coloration olivaceous, the sides with traces of vertical bars; first dorsal, ventrals, and anal black; second dorsal and caudal strongly barred with pale in fine pattern; head black in the male; lateral line complete. Fins shorter than in *olmstedi*, the scales larger; the form joined to both *nigrum* and *olmstedi* by series of variations. Length 3 inches. Tributaries of the James, Roanoke, and Rappahannock rivers; common. (*vexillaris*, carrying a standard, from the high fins.)

*Boleosoma vexillare*, JORDAN, Proc. U. S. Nat. Mus., 1879, 235, Rappahannock River, Warrenton, Virginia; a very extreme specimen with D. VIII–10; A. I, 7; scales 4–35–6; (Coll. Charles Hallock); JORDAN & GILBERT, Synopsis, 493, 1883.

*Etheostoma nigrum vexillare*, JORDAN, Bull. U. S. Fish Comm., VIII, 1888 (1890), 112 and 124.

Represented southeastward by

### 1446d. BOLEOSOMA NIGRUM MACULATICEPS (Cope).

Head 4; depth 6½; eye 3¾ in head. D. IX–13; A. II, 8; scales 5–41–10. Fins large; opercular spine moderate; cheeks naked. Pale yellowish, with ill-defined series of dorsal and lateral spots and many speckles between; top of head, nape, and muzzle marked with large brown spots; all the fins black, barred. Common in the upper waters of the Catawba River, North Carolina. (Cope.) (*maculatus*, spotted; *ceps*, head.)

*Boleosoma maculaticeps*, COPE, Proc. Am. Philos. Soc., 1870, 269, Upper waters of the Catawba River, North Carolina.

Another form or species of this type from Nebraska may be recorded as

### 1446e. BOLEOSOMA NIGRUM MESÆUM (Cope).

A stout, little compressed species, with large scales. Dorsals not in contact. Eye 5 in head, more than once in muzzle, anterior to its border; head 4½ in total length. Caudal very rounded, first scarcely as high as second dorsal. Pectorals longer than ventrals, not reaching vent. Scales 4–40–5. D. IX–13; A. 9; V. I, 4. Outline of back rather elevated. Beside the large size of the scales, the proportionately longer head and 4 soft ventral rays distinguish it from other species. The color in spirits is pale brown, with four dorsal blotches, and a few groups of zigzags on the sides. Second dorsal and caudal barred. (Cope.) We have the following additional notes upon the type of this species: Head 3¾ in length of body; pectoral as long as head; dorsal spines IX; the ventral rays appear to be really I, 4; anal spine weak. Cheeks naked; gill membranes separate. Eye not half as large as in specimens of *nigrum* of same size, 4⅕ in head in adult; snout more pointed than in other species of *Boleosoma*; mouth larger. Lateral line complete. A true *Boleosoma* and apparently a valid species. Type, a single specimen in poor condition in the Museum of the Academy of Natural Sciences at Philadelphia. Platte River, near Fort Kearney, Nebraska; only the type known. (*mesœus*, *μέσαιος*, intermediate.)

*Pœcilichthys mesæus*,* COPE, Proc. Ac. Nat. Sci. Phila., 1864, 232, Platte River, near Fort Kearney, Nebraska. (Coll. Dr. Hammond.)
*Boleosoma mesœum*, VAILLANT, Recherches, 98, 1873.

### 1447. BOLEOSOMA SUSANÆ (Jordan & Swain).

Head 4⅕; depth 6½. D. VIII–10 or 11; A, I, 8; scales 4–45 to 50–6. General form and appearance of *Boleosoma nigrum*, the body slenderer, the fins smaller, and the head entirely naked. Body very slender, fusiform, little compressed, the back not much elevated. Head short and small. Mouth small, inferior, formed as in other species of the genus. Snout short, bluntly decurved. Eye rather large, a little longer than snout, the maxillary extending to below front of pupil. Whole head, nape, breast, and middle line of belly naked. Scales rather large, the tubes of the lateral line wanting on the last 3 or 4. Fins moderate, the dorsals shorter and lower than usual in this genus, highest in the males. Anal spine single, weak. Pectorals rather long, reaching well beyond tips of ventrals, their length about equal to that of head. Color in life essentially as in *Boleosoma nigrum*, the males (in spring) with the head and fins jet black, the body blackish olive, barred with black. Females light olive, tessellated with darker, and with dusky spots along the lateral line. A dark spot before eye and one on back before dorsal; lower fins pale; both dorsals and caudal with darker bars. Length 2 inches. Basin of the Upper Cumberland River, Kentucky; locally abundant. A well-marked species, without bright colors; small and slender. (Named for Mrs. Susan Bowen Jordan, who was interested in life studies of the darters.)

*Boleosoma susanæ*, JORDAN & SWAIN, Proc. U. S. Nat. Mus., 1883, 249, Wolf Creek and other tributaries of the Clear Fork of Cumberland River, near Pleasant View, Whitley County, Kentucky (Type, No. 36501. Coll. Gilbert & Swain); BOULENGER, Cat., I, 94.

### Subgenus VAILLANTIA, Jordan.

### 1448. BOLEOSOMA CAMURUM, Forbes.

Head 4 to 4½; depth 5½ to 6½. D. IX or X–10 or 11; A. I, 7 or 8; scales 5 or 6–56 to 65–11, pores about 20 to 30. Body slender, moderately compressed, with long caudal peduncle. Back somewhat elevated. Head small, rather slender, the snout shorter than eye, strongly decurved. Eye 4 in head. Mouth inferior, horizontal, small, the maxillary extending nearly to middle of eye. Gill membranes little connected. Cheeks, opercles, and breast closely covered with rather large scales; median line of neck naked; opercular spine strong; scales moderate; lateral line quite short, nearly straight, reaching to middle of the spinous dorsal, developed on 20 to 30 scales. Fins small, the dorsals well apart; first dorsal larger than the second, which is larger than the small anal; pectoral as long as head. Coloration much as in *Boleosoma nigrum*, but rather paler, olivaceous; back spotted and tessellated; sides with about 10 irregular spots; a dark spot on opercles; head spotted above; a black line across the muzzle; no bar below eye; dorsals and caudal fin finely barred. Length 2½ inches. Indiana and Iowa to Alabama and southwest to Houston, Texas; common in Arkansas and southward in sandy streams. (*camurus*, snub-nosed.)

*Boleosoma camura*, FORBES, Bull. II, Ill. Lab. Nat. Hist., 40, 1878 (name preoccupied in *Etheostoma*, but not in *Boleosoma*), streams of Illinois (Coll. Forbes); BOULENGER, Cat., I, 96.

*Vaillantia chlorosoma*,* HAY, Proc. U. S. Nat. Mus., 1880, 495, tributary of Tuscumbia River at Corinth, Mississippi, Sandy Creek at Artesia, Mississippi, and Horsehunter Creek at Macon, Mississippi. (Type, No. 27428. Coll. Hay.)

*Vaillantia camura* and *chlorosoma*, JORDAN & GILBERT, Synopsis, 494, 1883.

## 472. CRYSTALLARIA, Jordan & Gilbert.

*Crystallaria*, JORDAN & GILBERT, in JORDAN, Cat. Fishes N. A., 78, 1885, (*asprella*).

Body slender, elongate, subcylindrical, pellucid in life; scales small, rough; lateral line complete. Mouth small; premaxillaries not protractile; teeth on jaws and vomer; cheeks and opercles scaly; opercle with a strong spine, gill membranes somewhat united; branchiostegals 6.

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* The following is the substance of Dr. Hay's account of *Boleosoma chlorosoma*:

*Boleosoma chlorosoma* (Hay).—Head 4½; depth 5¼. D. IX–11; A. I, 7 or I, 8; lateral line 50 to 60. Body slender, compressed, the dorsal region much arched. Caudal peduncle long and slender, the body abruptly contracted at the vent. Head small, convex in profile. Cheeks and opercles scaled. Breast scaled or naked. Dorsals separated by a distance equal to half the head, about equal to each other, larger than the anal. Lateral line developed on 4 to 20 scales. Greenish yellow, with many blotches and zigzag markings of brown; a row of about 10 of these blotches along each side, most distinct on caudal peduncle; about 8 square brown dorsal spots. Top of head, opercular spot, and subocular spot black. A black streak from eye to snout. Length 2 to 2½ inches.

Both dorsals and anal high and long; caudal notched; ventrals well separated; anal with one feeble spine. This genus differs from *Ammocrypta* chiefly in having the premaxillaries nonprotractile. The vertical fins are much more developed than in the latter genus, there being 14 dorsal spines and 12 soft rays in the anal fin. The squamation is much more complete than in *Ammocrypta*, but the body is similarly hyaline. The single species is one of the largest of the darters, much larger than the species of *Ammocrypta* or *Ioa*, resembling species of *Hadropterus* in habit. (*κρύσταλλος*, crystal.)

### 1449. CRYSTALLARIA ASPRELLA (Jordan).

Head long and slender, $4\frac{1}{5}$ to $4\frac{1}{2}$; depth 7 to 8; eye large. D. XII to XIV–13 to 15; A. I, 12 to 14; scales 7 to 10–98 to 100–10 (83 to 85 in specimens from Alabama). Body long, slender; mouth not large, subterminal, horizontal; premaxillaries not protractile; opercular spine well developed. Squamation much more complete than in *Ammocrypta pellucida*, the scales very small and quite rough, largest posteriorly; cheeks and opercles with pectinate scales; throat and belly naked, the space between the ventrals scaled; back of neck scaled. Fins large; the dorsals well separated, the spinous high, highest in front; second dorsal smaller, smaller than anal; anal spine high, flexible; caudal lunate. Color hyaline olive, with 3 or 4 dark, broad cross bands meeting over the back, the width of each of the first 3 about equal to depth of body, the fourth narrower, all extending somewhat obliquely downward and forward to the lateral line; a dark lateral band along side, made up of about 10 more or less confluent dark quadrate blotches, darkest where it passes through the cross bands. Southern Indiana and Illinois to Arkansas and Alabama, chiefly in the larger, clearer streams, where it is found in the swift currents. Recorded from the Ohio River, at Rising Sun (Jenkins); Wabash River, at New Harmony, Vincennes, and Terre Haute (Evermann); Green River, Kentucky (Woolman); Chocolo Creek, Alabama (Kirsch); and Washita River, Arkansas (Jordan & Gilbert), besides the original locality in Illinois, where it was first obtained by Dr. Forbes. A singularly interesting fish. (*asprellus*, a diminutive of *Aspro*.)

*Pleurolepis asprellus*,* JORDAN, Bull. II, Ill. Lab. Nat. Hist., 38, 1878, rocky tributary of Mississippi River in Hancock County, Illinois. (Coll. Forbes.)
*Ammocrypta asprella*, JORDAN & GILBERT, Synopsis, 490, 1883.
*Etheostoma asprellus*, EVERMANN & JENKINS, Proc. U. S. Nat. Mus., 1888, 56.
*Crystallaria asprellus*, BOULENGER, Cat., I, 104.

## 473. AMMOCRYPTA, Jordan.

### (SAND DARTERS.)

*Pleurolepis*, AGASSIZ, Bull. Mus. Comp. Zoöl., I, 5, 1863, (*pellucidus*), (not *Pleurolepis*, EGERTON, a genus of extinct Ganoids).
*Ammocrypta*, JORDAN, Bull. U. S. Nat. Mus., X, 6, 1877, (*beanii*).

Body slender and elongate, subcylindrical; pellucid in life. Head slender. Mouth rather wide, terminal, horizontal, the lower jaw included;

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* In the original description, copied in Jordan & Gilbert, Synopsis, 490, the count of fin rays of *Ammocrypta pellucida* was, by a slip, substituted for that of *Crystallaria asprella*.

premaxillaries very protractile; teeth on the vomer. Scales thin, ctenoid, little imbricated, present along the region of the lateral line and on the tail, sometimes wanting on the back or belly; lateral line complete, each tube occupying nearly the whole length of its scale. Head scaly or naked; no ventral plates, the belly naked. Gill membranes considerably united, forming an angle at their junction. Dorsal fins moderate, about equal to the anal fin and to each other; dorsal with about 10 spines; anal spine single, weak; ventrals well separated, behind pectorals, their spines feeble; pectorals pointed, symmetrical, of 12 to 15 rays. Vertebræ 23 + 21 = 44 (*A. pellucida*). Pyloric cœca 4. Frontal region of skull narrow, the parietal region unusually depressed, the bones of skeleton all slender and thin. Sutures of skull very distinct; supraoccipital crest obsolete. Foramen of hypercoracoid very large. Darters of moderate or rather large size, inhabiting the sandy bottoms of clear streams, where they bury themselves entirely, exceping the eyes and snout. Coloration translucent, with bright reflections. (*ἄμμος*, sand; *κρυπτός*, concealed.)

| | |
|---|---|
| *a.* Cheeks and opercles scaly; sides of body usually well scaled. | PELLUCIDA, 1450. |
| *aa.* Cheeks and opercles naked; body imperfectly scaled. | BEANII, 1451. |

### 1450. AMMOCRYPTA PELLUCIDA (Baird).

(SAND DARTER.*)

Head 4 to 4¾; depth 7 to 8½. D. X–10 (IX to XI-9 to 11); A. I, 8 to 10; scales about 75 (67 to 78), about 6 series above lateral line. Body elongate, nearly cylindrical, the flesh pellucid in life, but of firm, wiry texture; head stout. Cheeks, opercles, and temporal region scaled; the scales embedded and more or less cycloid. Neck above thinly scaled or naked; scales of body not very rough, those along lateral line and caudal peduncle most closely imbricated; belly entirely naked; opercle ending in a short, flat spine. Maxillary barely reaching to opposite the large eye; eyes high up, 3⅔ to 4 in head, nearly equal to snout, separated by a narrow, grooved space. Pectorals shortish, almost as long as head, reaching tips of ventrals, halfway to vent. Translucent; scales with fine black dots; a series of small, squarish olive or bluish blotches along the back and another along each side; lateral spots connected by a gilt band. Length 3 inches. Lake Erie to Minnesota, Kentucky and Texas; abounding in clear sandy streams; one of the most interesting of our fishes, burying itself in the sand by an instantaneous movement, leaving only its eyes and snout visible. (*pellucidus*, transparent.)

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* We have often brought home with us a "Johnny," "Speck," or "Crawl-a-bottom," of a different type from any of those whose habits we already knew. It had a very sharp nose which projected over its mouth; its body was exceedingly slim and round, as transparent as jelly, but hard and firm to the touch. Its belly and much of its back were quite bare of scales and those along its sides were small and inconspicuous. Our aquarium had been arranged for the convenience of our other *Etheostomine* friends and the bottom was thickly covered with stones, among which a small fish might easily hide. Several days passed after the introduction of the first *Ammocrypta*, which survived the change of water, when we noticed that it had disappeared. Careful search among the stones and around the geode only made it the more certain that it had gone and increased our wonder as to the way; for surely it had not been eaten, nor had it jumped out, unless, like Ariel, it could assume a "shape invisible." Finally, after going over every inch of the ground, there was discovered, under the nose of *Boleosoma*, which was standing, as usual, on its hands and tail, the upper edge of a caudal fin, and on each side of Boly's tail appeared a little black eye set in a yellow frame. *Ammocrypta* was buried! Was he dead? Slowly one eye was closed in a Darter's inimitable way—for they can outwink all animals in creation except owls—and a touch of a finger on its tail showed that it had lost none of its activity. It was quite improbable that it had been buried so completely by accident, we therefore cleared of stones a small spot, leaving the hard white sand exposed, and awaited developments. Then for days we watched it closely only to learn that it could bury itself with great celerity, for it was not caught in the act. But our patience was at last rewarded; for one morning, as we came out to breakfast, it put its nose, that we now know has a tip nearly as hard as horn, against the bottom, stood up nearly straight on its head and with

*Pleurolepis pellucidus* (BAIRD MS.) AGASSIZ, Bull. Mus. Comp. Zoöl., I, 5, 1863, no locality; the specimens from Black River, Ohio, the types of *Etheostoma pellucidum*, BAIRD MS., 1853, (Type, No. 1311. Coll. Baird); VAILLANT, Recherches, 138, 1873, with plate.
*Pleurolepis pellucidus*, JORDAN & COPELAND, Amer. Nat., 86, 1877.
*Ammocrypta pellucida*, JORDAN & GILBERT, Synopsis, 489, 1883; BOULENGER, Cat., I, 102.

Represented northwestward by

### 1450a. AMMOCRYPTA PELLUCIDA CLARA (Jordan & Meek).

This variety differs from the typical *pellucida* in having no scales along the nuchal region, and none on sides anteriorly, except the 5 or 6 rows along the lateral line; cheeks with few scales. It grades into the typical *pellucida*, although extreme forms are readily recognizable; scarcely worthy of separation from the species. Mississippi Valley, Wabash River, west to central Iowa and Minnesota and south to Arkansas and northern Texas. (*clarus*, clear.)

*Ammocrypta clara*, JORDAN & MEEK, Proc. U. S. Nat. Mus., 1885, 8, Des Moines River, Ottumwa, Iowa. (Type, No. 35828. Coll. Jordan & Meek.)
*Etheostoma pellucidum clarum*, EVERMANN & JENKINS, Proc. U. S. Nat. Mus., 1888, 49.

Represented southwestward by

### 1450b. AMMOCRYPTA PELLUCIDA VIVAX (Hay).

More fully scaled than typical *pellucida*, the region before the dorsal being more or less closely covered with scales; scales firmer and rougher. A dusky bar across base of soft dorsal. In other respects essentially as in *pellucida*. Pyloric cœca 4. Vertebra $21 + 20 = 41$. Length 1⅔ inches.

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a swift beating of the tail to right and left was in less than five seconds completely buried. The sand had been violently stirred of course, and just as it had nearly settled, probably in less than half a minute, its nose was put quietly out, and settling back left the twinkling eyes and narrow forehead alone visible. Since then we have kept scores of them in an aquarium arranged especially for their convenience and have often seen them burrow into the sand. They will remain buried so long as the water is pure and cool. Indeed, we now rely almost entirely on them to warn us when the water needs changing. When this need is felt they come out of the sand and lie on the bottom panting violently. We have been unable to discover any immediate incentive for the act. It seems to be entirely unpremeditated. A number of them in confinement lie helplessly on the bottom, motionless and slowly breathing, when one suddenly starts and buries his head and neck in the now whirling sand; by a motion as quick as thought, his tail beats frantically about and when again the clean sand lies smooth on the bottom the little eyes are looking at you like two glistening beads, as if to witness your applause at so clever a trick. We have never seen *Ammocrypta* taste of food, nor do we ever expect to do so; for although its mouth bristles with teeth, its small size forbids an attack on any game which we can offer. Its quiescent habits and the character of the bottoms to which it confines itself seem to indicate that its prey is minute if not microscopic. But speculation about what we do not know as to its food might lead us to speculation as to the origin of its characteristic features—how, for instance, the hard snout, the transparent muscles, and the burrowing habits are consequent on its loss of scales, or how the loss of unnecessary scales and of pigment cells is consequent on its burrowing habits. Then, when we have finished these matters, we might inquire how it came about that there are "Johnny Darters" at all, and why no other continent has them.—*Jordan & Copeland.*

Mississippi and northwest through Arkansas to Texas; in sandy streams. (*vivax*, vivacious.)

*Ammocrypta vivax*, HAY, Bull. U. S. Fish Comm., II, 1882 (1883), 58, Pearl River, Jackson, Mississippi. (Type, No. 32213. Coll. Hay.)

### 1451. AMMOCRYPTA BEANII, Jordan.

Head 3¾ to 4; depth 7½. D. VIII to X–10 or 11; A. I, 9 or 10; scales 65. Body greatly elongated, subcylindrical, transparent. Head rather large, heavier than in *Ammocrypta pellucida*. Mouth rather wide, nearly terminal; the upper jaw somewhat the longer; outer teeth strong, hooked. Opercular spine obsolete. Head entirely naked. Body naked, except the caudal peduncle, which is sparsely covered with thin, embedded scales, and a series of rather large scales along the sides, on which the lateral line runs. Dorsal fins high, wide apart, about equal in height to the anal fin and to each other; caudal fin emarginate. Color translucent, without bars or spots, the lateral line shining golden in life. Spinous dorsal with a large black spot on the membrane anteriorly, another near the middle, and some small ones behind; other fins with their membranes dusted with dark points. Length 2½ inches. Gulf States, Alabama to Louisiana; rather common in sandy bottoms of clear brooks in the pine woods. (Named for Dr. Tarleton Hoffman Bean, its discoverer.)

*Ammocrypta beanii*, JORDAN, Bull. x, U. S. Nat. Mus., 5, 1877, Notalbany River, Tickfaw, Louisiana, (Coll. Bean); BOULENGER, Cat., I, 103; JORDAN & GILBERT, Synopsis, 489.

*Ammocrypta gelida*, HAY, Proc. U. S. Nat. Mus., 1880, 490, Chickasawha River, Enterprise, Mississippi. (Young.) (Type, No. 27425. Coll. Hay.)

## 474. IOA, Jordan & Brayton.

*Ioa*, JORDAN & BRAYTON, Bull. U. S. Nat. Mus., XII, 88, 1878, (*vitrea*).

This genus differs from *Ammocrypta* chiefly in the presence of 2 well-developed spines in the anal fin. The anal fin is proportionately smaller, and the scales are larger and rougher, more fully covering the body. Species small and slender, translucent in life; abounding in sandy brooks of the southern pine woods. (*ἰός*, an arrow or dart.)

*a.* Cheeks and opercles closely scaled; anal rays II, 7. VITREA, 1452.
*aa.* Cheeks and opercles naked; anal rays II, 10. VIGIL, 1453.

### 1452. IOA VITREA (Cope).

Head 4 to 4½; depth 7 to 7½. D. VII to IX–11 to 14; A. II, 6 to 9; scales 50 to 62. Form of *Ammocrypta pellucida*, or a little less elongate. Head slender, acuminate; mouth not very small, maxillary reaching front of eye; temporal region scaled; eye 3⅔ in head, nearly equal to snout; cheeks and opercles covered with large, imbricated, very roughly ctenoid scales, these scales extending forward to the maxillary and backward to edge of opercle and on subopercle; the feeble opercular spine is almost hidden by them. Middle and lower part of the sides of the body covered with large, imbricated, very rough scales, these less closely set below; breast naked; behind the ventrals the middle line of the belly with some small scales, behind which is a naked space bounded by small embedded scales, and extending as far as the vent; back, from middle of first dorsal forward, naked, posteriorly more or less scaly. Fins low and small, the second dorsal longer than the first or the anal, the spines slender; anal spines short; pectoral fins long and narrow. Translucent, with small dark spots on back and sides, besides finer specklings; fins plain. Length 2 inches. Southeastern Virginia and eastern North Carolina; locally abundant in clear sandy streams in pine woods. (*vitreus*, glassy.)

*Pœcilichthys vitreus*, COPE, Proc. Amer. Philos. Soc. Phila., 1870, 263, Walnut Creek, a tributary of Neuse River, Wake County, North Carolina. (Coll. Cope.)
*Ioa vitrea*, JORDAN & GILBERT, Synopsis, 490, 1883.
*Ammocrypta vitrea*, BOULENGER, Cat., I, 102.

### 1453. IOA VIGIL, Hay.

Head 3¾; depth 6; eye 3, greater than snout. D. X–12; A. II, 10; scales about 60 in longitudinal series. Body slender; head long; caudal peduncle compressed and comparatively deep, the fish, therefore, having nearly the same depth throughout its length. Top of head sloping gradually from occiput to snout. Upper jaw protractile; mouth large, terminal, slightly oblique; the jaws equal, maxillary reaching anterior edge of pupil; interorbital space very narrow; jaws with recurved teeth; opercular spine well developed; opercles and cheeks naked. Dorsal fins well separated; the origin of spinous dorsal ⅓ distance from snout to base of caudal, its length ⅘ and its height ⅕ length of head; soft dorsal same size as spinous. Length of anal fin ⅔ length of head, its height ½ head. Posterior portion of body densely scaled, anterior portion probably with few scales above, but none below the lateral line. Pale straw color or pellucid in life with some blotches and specks of olive, about 10 square spots along the back, and about as many along the lateral line, most distinct posteriorly; top of head dusky; a small but distinct black spot at base of caudal. Length 1 inch. (Hay.) Only one specimen known. Pearl River, Jackson, Mississippi; a rather doubtful species, possibly a variation of *Ammocrypta beanii*. (*vigil*, wide awake.)

*Ioa vigil*, HAY, Bull. U. S. Fish Comm., II, 1882 (1883), 59, Pearl River, Jackson, Mississippi. (Coll. Hay.)

The genus *Ammocrypta* represents the extreme of development of the series of darters with elongate bodies, a natural series being formed from *Percina* through *Hadropterus*, *Ulocentra*, and *Boleosoma* to *Crystallaria* and *Ammocrypta*. Another well-marked series, at first parallel with these and closely related to its members, leads off from *Hadropterus* and *Ulocentra* through *Etheostoma*, culminating in *Microperca*. This second series is distinguished as a whole by firmer skeleton with fewer vertebræ, the skull more convex in cross section, the anal fin smaller and the fin rays tending to become fewer. In habits, the species of the second group are more quiescent, swimming less freely for a distance, but lying at rest for some time, then moving with sudden jerks. In this series bright blue or red coloration in the males is more frequently observed. We begin the series with the chief group, *Etheostoma*, a group from which as a whole *Hadropterus* can scarcely be separated.

## 475. ETHEOSTOMA, Rafinesque.

*Etheostoma*, Rafinesque, Journ. de Physique., etc., Paris, 1819, 419, (*caprodes*, *blennioides*, *flabellare*; first restricted by Agassiz, 1854, to *aspro*, wrongly identified as "*blennioides*;" restricted by Cope & Jordan, 1877, to *flabellare*).

*Pœcilosoma*, Agassiz, Lake Superior, 1850, 299, (*variatus*) (name preoccupied).

*Pœcilichthys*, Agassiz, American Journal Sci. and Arts, 1854, 305, (*variatus*).

*Catonotus*, Agassiz, American Journal Sci. and Arts, 1854, 305, (*flabellatus*).

*Oligocephalus*, Girard, Proc. Ac. Nat. Sci. Phila., 1859, 67, (*lepidus*).

*Nothonotus*, Agassiz, Bull. Mus. Comp. Zoöl., I, 3, 1863, (*maculatus*).

*Astatichthys*, Vaillant, Recherches sur les Etheostomatina, 107, 1873, (*cæruleus*).

*Nanostoma*, Putnam MS., Jordan, Bull. U. S. Nat. Mus., x, 6, 1877, (*zonalis*) (not *Nannostomus*, Günther).

*Rhothœca*, Jordan, Rept. U. S. Fish Comm., 1885, 868 (*zonalis*, substitute for *Nanostoma*, regarded as preoccupied by *Nannostomus*).

*Torrentaria*, Jordan & Evermann, new subgenus, (*australe*).

*Nivicola*, Jordan & Evermann, new subgenus, (*boreale*).

*Rafinesquiellus*, Jordan & Evermann, new subgenus, (*pottsii*).

*Claricola*, Jordan & Evermann, new subgenus, (*juliæ*).

Body robust, or rather elongate, compressed. Mouth terminal, or subinferior, varying in size; the lower jaw included or not; premaxillaries not protractile; maxillary movable. Teeth rather strong, usually present on vomer and palatines. Gill membranes separate or more or less broadly connected. Scales moderate or small, ctenoid; top of head without scales; scales of the middle line of the belly persistent and similar to the others; lateral line well developed, nearly straight, often wanting posteriorly; fins large, with strong spines; first dorsal usually longer and larger than the second, with 7 to 15 spines; anal with 2 strong spines, the anterior usually the larger, the second rarely obsolete; anal fin always smaller than the soft dorsal; ventral fins more or less close together. Skull narrow, the parietal region very strongly convex in cross section; supraoccipital crest very small or wanting; lower pharyngeals very narrow. Vertebræ 33 to 39, usually $15+21=36$. Pyloric cœca 3 or 4. Bones rather firm. Coloration various, often brilliant. As here understood, a very large genus covering a great variety of forms. Many attempts at further subdivision have been made and some of the subgenera indicated below have been considered of generic value. Intergradations of all sorts occur and the technical characters do not always indicate the real relationship. Many of the species are excessively variable, each brook having its peculiar race. (The word *Etheostoma* is stated by Rafinesque to mean "various mouths," the species known to him, i. e., *Percina caprodes*, *Diplesion blennioides*, and *Etheostoma flabellare*, being so different in respect of the form of the mouth that he conceived that they might belong to different subgenera. The etymology of the word is not evident, unless it be from *ἠθέω*, to strain, and *οτόμα*, mouth; *ἕτερός*, different, and *στόμα*, would make *Heterostoma.*)

*a.* Lateral line complete (a few tubes very rarely wanting).

*b.* Gill membranes more or less broadly connected across the isthmus; ventrals separated by a distinct interspace, which is not so wide as base of the fin; anal spines normally 2.

PŒCILICHTHYS (*ποικιλός*, variegated; *ἰχθύς*, fish):

*c.* Anal fin nearly as large as soft dorsal; spinous dorsal with about 13 spines; head almost naked; fins very large; colors brilliant. VARIATUM, 1454.

NANOSTOMA (*νανὸς*, small; *στόμα*, mouth):

*cc.* Anal fin much smaller than soft dorsal; spinous dorsal with 9 to 12 spines.

*d.* Head entirely naked.

*e.* Scales moderate, 48 to 57; pectoral $\frac{1}{3}$ longer than head; D. about XII–13; sides with dark green spots. SWANNANOA, 1455.

*ee.* Scales rather large, 40 to 48.

*f.* Pectoral about as long as head; D. about X–11.

*g.* Head large, $3\frac{2}{3}$ to 4 in length; sides with dark green blotches. THALASSINUM, 1456.

*gg.* Head rather small, $4\frac{3}{4}$ in length; males with series of scarlet spots along the rows of scales. INSCRIPTUM, 1457.

*ff.* Pectoral much longer than head; D. XII–12; body robust; the depth $4\frac{1}{2}$ in length; color olive with dark oblique bars. BLENNIUS, 1458.

*dd.* Head not entirely naked.

*h.* Cheeks naked; opercles scaly; scales 50 to 60; body slender, the depth $5\frac{3}{4}$ in length; color green, with darker markings. RUPESTRE, 1459.

*hh.* Cheeks and opercles scaly (rarely naked); body slender, the depth 5 to 6 in length. D. about X–11; pectoral about as long as head.

*i.* Scales about 42; males with series of dark spots along the rows of scales. ELEGANS, 1460.

*ii.* Scales about 50; no distinct dark spots along series of scales. ZONALE, 1461.

NOTHONOTUS (*νοθός*, prominent; *νῶτος*, back):

*bb.* Gill membranes scarcely connected across isthmus; first dorsal long; anal rather small; ventrals near together, the interspace very narrow.

*j.* Humeral region without enlarged black scale.

*k.* Head short, the muzzle abruptly decurved; scales 50 to 58; vertical fins black-edged; breast blue in life.

*l.* Dorsal spines 11 or 12. CAMURUM, 1462.

*ll.* Dorsal spines 14. VULNERATUM, 1463.

*kk.* Head rather long and pointed, the snout not decurved.

*m.* Scales rather small, 56 to 63; body and fins variegated with red.

*n.* Color olive; throat blue; sides in male with crimson spots and a brown, wavy, lateral band. D. XII–12. MACULATUM, 1464.

*nn.* Color yellowish, with 4 dark bars; 10 to 12 oblong dark spots on sides; fins with red in male; D. XI–12. CINEREUM, 1465.

*nnn.* Color greenish, with 8 to 10 transverse bluish bands; between each pair a bluish rhomb; a black caudal spot; fins with yellow. D. XII–13. TESSELLATUM, 1466.

*mm.* Scales rather large, about 45; male olive with quadrate red spots on sides; breast blue; belly orange; fins ornate; form robust. RUFILINEATUM, 1467.

*jj.* Humeral region with an enlarged black scale; scales 43 to 55. D. X–11; color olivaceous, with 8 to 10 dark cross bars; form robust. JORDANI, 1468.

*aa.* Lateral line more or less incomplete (occasionally nearly or quite complete in *jessiæ* and in *squamiceps*); ventrals close together, the interspace very slight; first dorsal and anal rather small.

TORRENTARIA (*torrens*, a swift stream):

*o.* Anal spine single as far as known; head naked or very nearly so; a black humeral process or scale; snout sharp, the mouth large.

*p.* Scales 68; body and head very long and slender. A. I, 10; gill membranes separate. SAGITTA, 1469.

*pp.* Scales 58 to 66; body rather deep, the head slender. A. I, 7 or 8; gill membranes moderately connected; body with sharp cross bands. AUSTRALE, 1470.

*oo.* Anal spines normally 2.

*q.* Gill membranes scarcely connected; lower jaw moderate, not projecting.

NIVICOLA (*nix*, *niveus*, snow; *colo*, to inhabit):

*r.* Fins very small, the dorsal rays VIII-9; cheeks and opercles scaly; scales 53. BOREALE, 1471.

*rr.* Fins not very small. Dorsal spines 9 to 13; the soft rays 10 to 14.

RAFINESQUIELLUS*:

*s.* Dorsal fins more or less connected; last dorsal spine not longer than next the last; a dark humeral scale; coloration mottled; form very robust, the depth about 4 in length; scales 44 to 50. POTTSII, 1472.

OLIGOCEPHALUS (ὀλιγός, few, small; κεφαλή, head):

*ss.* Dorsal fins well separated, the last dorsal spine short; form comparatively slender.

*t.* Humeral region without differentiated black scale-like process; sometimes with a faint dark spot.

*u.* Scales between spinous dorsal and lateral line 4 to 7.

*v.* Head not entirely naked.

*w.* Cheeks and opercles more or less closely scaled.

*x.* Scales small, about 60; soft dorsal with 10 or 11 rays; body slender. IOWÆ, 1473.

*xx.* Scales moderate, 41 to 55; soft dorsal rays 12 or 13.

*y.* Lateral line almost or quite complete; sides in male with bluish bars or blotches. JESSIÆ, 1474.

*yy.* Lateral line with 30 to 35 tubes only; sides with alternate yellow and dark cross bars. LUTEOVINCTUM, 1475.

*ww.* Cheeks scaly; opercles naked; scales 54 to 61. D. X–12; sides with faint dark cross bars. LEPIDOGENYS, 1476.

*www.* Cheeks naked or nearly so; opercles more or less scaly; scales rather large, about 48; males with alternate oblique bars of red and blue; fins ornate. CÆRULEUM, 1477.

*vv.* Head entirely naked; scales about 48; form and coloration of *Etheostoma cæruleum.* LEPIDUM, 1478.

*tt.* Humeral region with a distinct black process or scale.

*z.* Cheeks mostly naked, opercles scaly; scales about 50; body banded; fins rather large. D. XII–12. TIPPECANOE, 1479.

*zz.* Cheeks and opercles naked, or very nearly so.

*a'.* Scales very small, 63 to 80; body everywhere much dotted with black. PUNCTULATUM, 1480.

*aa'.* Scales moderate, less than 62 in number.

*b'.* Scales of sides not marked, each with a dark spot, these forming continuous stripes.

*c'.* Scales 46 to 55; snout much shorter than eye, which is 3½ in head. CRAGINI, 1481.

*cc'.* Scales 45 to 50, snout as long as eye, which is 5 in head. OBEYENSE, 1482.

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* Named for Constantine Samuel Rafinesque, who first recognized the existence of darters in the streams about the falls of the Ohio (Louisville, Kentucky).

*bb′*. Scales of back and sides each with a dark spot, these forming continuous streaks.

*d′*. Scales 56 to 61; male with the belly red; snout rounded. PAGEI, 1483.

*dd′*. Scales 53; no red; snout pointed. VIRGATUM, 1484.

*qq*. Gill membranes more or less broadly connected across isthmus; usually an enlarged black humeral scale.

CLARICOLA (*clarus*, clear; *colo*, to inhabit):

*e′*. Lower jaw scarcely projecting; head more or less scaly; spines in males without knobs.

*f′*. Scales usually less than 60.

*g′*. Body robust, the depth 4 to 4⅕ in length; snout sharp; mouth rather large; greenish with dark markings. JULIÆ, 1485.

*gg′*. Body rather slender, the depth 4½ to 5 in length.

*h′*. Cheeks scaly; male with dark bars and red blotches on sides of body. ARTESIÆ, 1486.

*hh′*. Cheeks naked, or with embedded scales; male with red spots along sides of body. ALABAMÆ, 1487.

*ff′*. Scales usually more than 60.

*i′*. Cheeks usually naked or nearly so; pores wanting on 16 to 20 scales; male with red spots and red markings on fins. WHIPPLII, 1488.

*ii′*. Cheeks usually scaly; pores wanting on few (usually not more than 4 or 5) scales; fins low; no red in life. SQUAMICEPS, 1489.

ETHEOSTOMA:

*ee′*. Lower jaw strongly projecting; head entirely naked; dorsal spines low, each ending in a small, fleshy knob in the male; colors dark, no red nor blue; fins checkered. FLABELLARE, 1490.

### Subgenus PŒCILICHTHYS, Agassiz.

### 1454. ETHEOSTOMA VARIATUM, Kirtland.

Head 3½ to 4⅗; depth 4⅘ to 5½; eye 3½ to 3¾ in head. D. XII to XIV–11 to 13; A. II, 7 to 9; scales 8–51 to 63–12. Body moderately elongated, not much compressed, the back somewhat arched. Head short and thick, the snout short and blunt, and the profile above the eyes strongly decurved; profile a little depressed at the nape. Eyes large, not very close together, slightly longer than snout. Mouth small, low, subhorizontal, the lower jaw included; teeth small, subequal, bluntish, in rather broad bands; teeth on vomer. Premaxillary not protractile; maxillary reaching front of eye, 4 in head. Top of head extremely rugose, the wrinkles evident through the skin, and radiating irregularly from behind the eye. Parietal region rather broad and depressed, as in species of *Hadropterus*. Preopercle entire; opercle with a rather sharp spine. Gill membranes somewhat broadly united, but meeting at a rather acute angle. Head naked, except for 1 to 3 scales on the upper part of the opercle; scales of body rather large, ctenoid; lateral line complete; nape covered with small scales; breast loosely scaled; belly covered with ordinary scales similar to those on the sides; no enlarged ventral plates. Fins all very large; dorsal fins slightly joined; anal fin large, but lower than the soft dorsal, and somewhat shorter; pectorals as long as head, reaching front of anal; second anal spine longer than first, both of moderate size; longest dorsal spine 2⅘ in head; longest soft ray 1⅕; caudal subtruncate, its longest ray 1½ in head; longest ray of anal 1¾; pectoral a little longer than head; ventral a little shorter. Color of large male specimen, dusky greenish above, the head similar, the centers of the scales darker, and the whole body covered with fine dark points visible with a lens; belly and sides of the body from anal fin forward and as high up as the level of the scapula of a bright yellow orange; posterior parts of the body with 5 vertical zones of bright orange, these about half as broad as the dark greenish interspaces; first zone opposite the interspace between the dorsals and extending downward to front of anal; the last two on caudal peduncle; a vague, dusky area on base of caudal; a dusky shade across nape in front of dorsal, with 2 or 3 blackish cross blotches on back behind it; head nearly plain, with some dark specks and some dashes of orange; breast with light-orange shades; first dorsal with a broad median band of blue black; a paler stripe below it and above it; the base of the fin with dark interspinal spots, and the edge of the fin again blackish; second dorsal blue black, dashed with orange toward the base; caudal blackish, rather darker at base; anal blue black, with orange yellow at the base; pectoral blackish, with orange cross shades; ventrals blue black, with some edgings of orange. Young examples similarly marked, but paler in color, with more distinct markings, especially the dark cross bars on back, which are often very distinct, much as in *Cottogaster uranidea*; fins in females and young paler. Length 3⅓ inches. Ohio River basin from western Pennsylvania,* through Ohio, Indiana, and Kentucky; generally rare, probably more common southward. A large, handsome species, not recognized for nearly thirty years after its discovery, the name *variatus* having been meanwhile transferred to other species (*cœruleum* and *peltatus*). (*variatus*, variegated.)

*Etheostoma variatum*, Kirtland, Zoölogy of Ohio, 168, 192, 1838, Mahoning River, Ohio; Boulenger, Cat., I, 81.

*Etheostoma notatum*, Agassiz MS., Putnam, Bull. I, Mus. Comp. Zoöl., 4, 1863, (name only).

*Hadropterus tessellatus*, Jordan, Bull. X, U. S. Nat. Mus., 7, 1877, Alleghany River, Foxburg, Pennsylvania. (Coll. Baird.)

*Hadropterus variatus*, Jordan, Proc. U. S. Nat. Mus., 1885, 163; rediscovery of the species from Whitewater River, Brookville, Indiana. (Coll. Amos. W. Butler.)

*Boleosoma variatum*, Vaillant, Recherches, 84, 1873.

## Subgenus NANOSTOMA,† Putnam.

### 1455. ETHEOSTOMA SWANNANOA, Jordan & Evermann.

Head 4⅓; depth 6; eye 4 in head. D. XI or XII-12 to 14; A. II, 9; scales 6–48 to 57–7 or 8. Form of *Ulocentra simotera*. Body robust, somewhat compressed, the back elevated; head very short, deep, the anterior profile strongly convex; snout short and blunt; eye large, placed high; mouth very small, horizontal, inferior, the lower jaw included all around. Premaxillaries not protractile; maxillary short, not adnate, reaching to opposite front of eye, 4 in head; teeth small. Cheeks, opercles, and breast naked; nape naked in one specimen examined, scaly in the others; lateral line complete; belly evenly scaled. Gill membranes broadly connected. Fins rather low; dorsals contiguous; pectorals long, ⅓ longer than head, reaching beyond ventrals to vent. Males, in spirits, dusky green, the belly paler; back irregularly mottled and blotched with black and strewn with specks of saffron yellow; 6 distinct black cross blotches on dorsal line; 8 to 10 roundish or quadrate black blotches on sides, a smaller spot behind the last of these at base of caudal, these lateral blotches somewhat connected; head dusky above; a faint bar below eye; axil black; fins nearly plain. In life, male olive green, light green below; markings all dark green; base and lower edge of pectoral tinged with saffron; base and tip of first dorsal bright snuffy brown; second dorsal and caudal olive, speckled; lower fins pale yellow. Female and younger specimens have the body more speckled; the pectorals and caudal barred with dark. Length 2½ to 3 inches. Upper waters of the Tennessee River; locally abundant; a beautiful little fish, thus far known only from the clear, cold waters of the middle and south forks of the Holston and the south fork of the Swannanoa, a most beautiful stream flowing from the flanks of Black Mountain into the French Broad.

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* A specimen in the Museum of Comparative Zoölogy from Easton, Pennsylvania (Delaware River), seems to belong to *Etheostoma variatum*. Anal large; dorsal spines 12; scales 49. Gill membranes united; belly scaled; premaxillary not protractile; a dark spot on last dorsal spine, color otherwise faded. There is no other record of this species from east of the Alleghanies, and this locality may be doubtful.

† This group is very closely allied to *Ulocentra*.

*Etheostoma swannanoa*, JORDAN & EVERMANN, Proc. U. S. Nat. Mus., 1888, 360, South Fork of Holston River, Holstein Mills, Virginia; Middle Fork of Holston River, Marion, Virginia, and South Fork of Swannanoa River, Black Mountain, North Carolina (Type, No. 39861. Coll. Jordan, Evermann and Jenkins); BOULENGER, Cat., I, 81.

### 1456. ETHEOSTOMA THALASSINUM (Jordan & Brayton).

Head 3⅔ to 4; depth 4¾ to 5; eye 3½ to 4 in head. D. IX to XI-10 to 12; A. II, 7 or 8; scales 5-40 to 48-7. Body rather stout, compressed behind, the back somewhat arched. Head large, the snout rather blunt and convex in profile. Eye large, high up, about equal to snout; interorbital space rather narrow. Mouth moderate, slightly oblique, the maxillary reaching to the orbit. Upper jaw slightly longer than the lower. Head entirely naked; throat naked; neck naked anteriorly; opercular spine obtuse; Fins all large; membrane of the first dorsal continued to the base of the second; longest dorsal spine scarcely shorter than the soft rays, the base of the spinous dorsal a little longer than that of the soft dorsal; anal not much smaller than the soft dorsal, its first spine the longer; caudal fin deeply lunate; pectorals as long as head, reaching nearly to vent. Male, in life, with body dark green and blotched above; sides with 6 to 9 dark blue-green vertical bars, the 5 next the last most distinct; spinous dorsal reddish at base, then a broad black band, the uppermost third of a bright ferruginous red; second dorsal blackish at base, reddish above; caudal with 2 orange blotches at base, black mesially, pale orange distally; anal fin of a brilliant blue-green color at base, pale at tip; ventrals greenish; head mostly grass green; the streaks forward and downward from eye dark green; females duller and more speckled. Length 2½ inches. Santee River basin in North and South Carolina; locally very abundant; a pretty species. (*thalassinus*, sea green, from θάλασσα, sea.)

*Nothonotus thalassinus*, JORDAN & BRAYTON, Bull. XII, U. S. Nat. Mus., 13, 1878, Reedy River, Greenville, South Carolina; Catawba River and tributaries in North Carolina; Ennoree River, Chick Springs, South Carolina; and Saluda River, Farr's Mill, South Carolina, (Type, No. 31122. Coll. Jordan & Brayton); JORDAN & GILBERT, Synopsis, 511, 1883.

*Etheostoma thalassinum*, JORDAN, Bull. U. S. Fish Comm., VIII, 1888 (1890), 139; BOULENGER, Cat., I, 83.

### 1457. ETHEOSTOMA INSCRIPTUM (Jordan & Brayton).

Head 4¾; depth 4¾; eye 3½, about equal to snout. D. XI–12; A. II, 8; scales 5–46–5. Body rather stout and deep, strongly compressed. Caudal peducle rather deep. Head large, rather obtuse, the profile quite gibbous, a considerable angle formed opposite the eyes, which are high up and close together. Mouth moderate, slightly oblique, the maxillary reaching eye, the upper jaw the longer. Head entirely scaleless; neck above scaly; breast naked; belly closely scaled; scales large. Fins large; spinous dorsal longer than soft dorsal, which is somewhat larger than the anal; the 2 dorsals connected by membrane; dorsal spines a little more than half the length of the head; pectorals large. Color olive, with a bright scarlet spot on each scale, these forming continuous lines along the rows of scales; 3 dark blotches across the back; 1 in front of dorsal, forming a black spot on the anterior spines; 1 between the 2 dorsal fins, forming a similar black spot on the last rays of the spinous dorsal, and 1 on the caudal peduncle, behind the second dorsal; sides with about 6 irregular dark-olive blotches just below the lateral line; edge of spinous dorsal black, below this bright orange red, a dusky bar at the base; entire anal fin, cheeks, opercles, and a bar below the eye bright blue; females without red spots, the sides blotched. Length 2½ inches. Oconee River, Georgia; scarce; one of the most beautiful of the group. (*inscriptus*, written on, from the markings.)

*Nothonotus inscriptus*, JORDAN & BRAYTON, Bull. XII, U. S. Nat. Mus., 34, 1878, Oconee River, at Sulphur Springs, Hall County, Georgia. (Coll. Jordan & Brayton).

*Nanostoma inscriptum*, JORDAN & GILBERT, Synopsis, 512, 1883.

### 1458. ETHEOSTOMA BLENNIUS, Gilbert & Swain.

Head $4\frac{2}{7}$; depth $4\frac{3}{7}$; eye 1½ in snout, 4½ in head. D. XII–12; A. II, 8; scales 5–43–8. Body exceedingly robust, little compressed, the ventral outline more strongly arched than dorsal outline; greatest depth opposite front of spinous dorsal, the 2 profiles thence converging rapidly backward to form the rather long, slender, caudal peduncle. Head very deep, with subvertical cheeks, broad below, narrowing upward and forward. Profile from nape to middle of interorbital space nearly horizontal, thence abruptly and very obliquely decurved to tip of snout. Middle of eye equidistant from tip of snout and front of nape. Greatest depth of preorbital $\frac{2}{7}$ length of head. Mouth very small, subinferior, the lower jaw included. Length of maxillary equaling distance from tip of snout to anterior nostril. Premaxillaries not protractile, the fold of upper lip interrupted by a very narrow frenum, as is the case in some specimens of *Ulocentra simotera*, to which species the present one is really closely related. Vomer with teeth. Opercular spine very little developed, the opercle terminating in a flat point, scarcely projecting beyond the membrane. Gill membranes very widely joined across isthmus, the width of the union being $\frac{2}{3}$ distance from posterior margin of membrane to tip of lower jaw. Eye small, high up. Spinous dorsal long and rather low, composed of stiff spines, the membrane of last spine joining base of first soft ray; the middle spines the highest, about half length of head; second dorsal shorter and higher than the first, much larger than the small anal fin, its longest ray 1$\frac{2}{5}$ in head. Anal spines short and robust, the first longer than second; longest anal ray about equaling length of snout; caudal lunate; pectorals very large, reaching much beyond ventrals, about $\frac{1}{3}$ length of body. Ventrals equaling distance from snout to base of pectorals; least depth of caudal peduncle $\frac{2}{5}$ depth of body. Body covered with very large scales, those on nape somewhat smaller; head and breast wholly naked; lateral line complete, straight. Color in life: Light olive green above, with 4 conspicuous blackish-brown cross bars, narrower than the interspaces, running from back downward and forward to below lateral line; the first, very broad, occupies the entire nape, and terminates above base of pectorals; the second, much narrower, begins below end of spinous dorsal; the third below last rays of soft dorsal; the last bar much less conspicuous on back of caudal peduncle. On middle of each light interspace is a similar, somewhat broader bar, less clearly marked, and with ill-defined boundaries, these bars terminating below lateral line in 7 or 8 dusky blotches; each scale on back and sides with the central portion light red, changing to golden brown in spirits; belly and lower fourth of sides silvery white; two bright areas at base of caudal, with a blackish bar immediately behind them; caudal indistinctly barred with dusky. Dorsals translucent, the membrane between each 2 rays with an elongate dusky-red blotch, extending $\frac{2}{3}$ height of fin; spinous dorsal margined with light red; pectorals barred with dusky and light yellowish; ventrals with traces of similar bars; anal translucent, an indistinct yellowish band along its middle. Length 2$\frac{4}{5}$ inches. Northern Alabama, in small streams tributary to the Tennessee River; not common; a strongly marked species. (*Blennius*, a blenny, from the form of the head.)

*Etheostoma (Rhothœca) blennius*, Gilbert & Swain, Proc. U. S. Nat. Mus., 1887, 55, Cox's Creek and Shoal Creek, tributary to the Tennessee River, Florence, Alabama, (Type, No. 36187. Coll. Gilbert & Swain); Gilbert, Bull. U. S. Fish Comm., ix, 1889 (1891), 150.

### 1459. ETHEOSTOMA RUPESTRE, Gilbert & Swain.

Head 3$\frac{4}{5}$ to 4; depth 5$\frac{3}{4}$. D. XI or XII–11 or 12; A. II, 7 or 8; scales 50 to 57, 6 or 7 series above lateral line. Closely related to *Etheostoma thalassinum*, from which it may be distinguished by its more slender form.

the absence of bright coloration, the smaller scales, and the squamation of the opercle. Body slender, fusiform, little compressed, the upper anterior profile descending rapidly to tip of snout. Mouth small, horizontal, terminal at lower side of snout, the lower jaw included; maxillary reaching vertical from front of orbit, its length slightly less than diameter of eye, 3½ in head, in specimens 1½ inches long. Interorbital space very narrow, its width half diameter of orbit. Gill membranes widely joined, free from the isthmus. Scales small, 6 to 7 longitudinal series between lateral line and the base of the spinous dorsal; tubes of lateral line usually 55 or 56 in number, varying from 50 to 57; lateral line complete, straight; opercle more or less completely covered with scales as large as those on sides; cheeks and breast naked, the nape closely scaled. Fins of moderate size, the spines weak and flexible; length of dorsal spines equaling distance from tip of snout to middle of orbit; anal spines short, about equal in size, their length less than diameter of orbit; pectorals long, reaching beyond vertical from vent, their length 3 to 3½ times in length of head and body; ventrals reaching vent; caudal short, not deeply notched, 4½ in length. Coloration in life: Grass green, with dark markings, but no red or blue; back with 6 dark cross bars, wider than the light interspaces; a series of 6 dark blotches, sometimes W-shaped along sides, immediately below lateral line; usually 4 dark spots at base of caudal, 2 of which are closely approximated at base of median caudal rays; dark vermiculations on top of snout; a dark bar downward, and 1 downward and forward from eye; fins with wavy, dusky bars. North River, a tributary of the Black Warrior River, Alabama. (*rupestris*, living among rocks.)

*Etheostoma rupestre*, GILBERT & SWAIN, Proc. U. S. Nat. Mus. 1887, 57, North River, near Tuscaloosa, Alabama, (Type, No. 36695. Coll. Gilbert & Swain); BOULENGER, Cat., I, 82.

### 1460. ETHEOSTOMA ELEGANS (Hay).

Head 4; depth 5; eye 4 in head. D. X-12; A. II, 8; scales 5-42-6. Body stout, somewhat compressed. Head short and deep, with swollen cheeks; snout abruptly decurved; mouth subterminal, horizontal, small, the maxillary not reaching the front of eye. Lateral line nearly straight; cheeks, opercles, and back of neck scaly; chest and region just behind ventrals naked. Spinous dorsal half as high as long, a little longer than the head; soft dorsal ⅚ as long as head and ⅔ as high as long; anal ¾ length of head, as high as long; pectoral fins very large, reaching beyond ventrals to vent. Color purplish; 6 large, quadrate, black blotches along back, and 8 broad, transverse bars along sides fainter, these alternating with dark spots; many of the scales above with jet-black spots, forming longitudinal streaks; 2 black spots at base of caudal, as in *zonale*, but larger and brighter; a few black spots behind eye; dark spots downward and forward from eye; ventral and anal fins indigo blue; pectorals with blue; a bar of deep orange red along base of both dorsals; female with the lower fins pale. Thought by Dr. Gilbert to be based on highly colored examples of *Etheostoma zonale*, which is not unlikely, but the coloration is more like that of *E. inscriptum.* Length 2¼ inches. Chickasawha River, Mississippi. (*elegans*, elegant.)

*Nanostoma elegans*,[*] Hay, Proc. U. S. Nat. Mus., 1880, 493, shallow rocky branch of Chickasawha River, Enterprise, Mississippi, (Type, No. 27455. Coll. Hay); Jordan & Gilrert, Synopsis, 510, 1883.

*Etheostoma lynceum*, Hay MS., Jordan, Cat. Fish. N. A., 80, 1885; same type; name a substitute for *elegans*, as *Boleichthys elegans*, Girard, was then placed in *Etheostoma.*

### 1461. ETHEOSTOMA ZONALE (Cope).

Head 4 to 5; depth 5 to 6. D. X or XI–10 to 12; A. II, 6 to 8; scales 6–48 to 53–9, pores 44 to 50. Body slender, somewhat compressed. Head small, rather short; the mouth small, subinferior. Snout very short, decurved, rather obtuse, maxillary scarcely reaching front of eye; eye longer than snout, 3½ to 4 in head. Cheeks, opercles, and neck, more or less scaled, breast usually naked. Teeth very feeble, those on vomer not evident, probably none on the palatines. First dorsal well developed, separated from the second, which is higher and shorter than the spinous dorsal, and considerably larger than the anal; caudal emarginate, pectoral as long as head or a little longer. Bright olivaceous above, golden below; 6 dark brown quadrate dorsal spots, which connect by alternating spots with a broad, brown, lateral band, from which 8 narrower dark bluish bands more or less completely encircle the belly; paired, anal, and caudal fins golden, brown-spotted; middle half of the first dorsal crimson; a series of round crimson spots near the base of the second dorsal; occiput, a band on muzzle and 1 below eye, black; a black spot on operculum and 1 at base of pectoral; females duller and speckled, with ventrals barred and lateral bars feebler. Length 3 inches. Mississippi Valley from Ohio, northern Indiana (Kankakee River), west through Iowa, and south through Kentucky and Tennessee to Alabama, Louisiana, and Arkansas, in small, clear streams; locally abundant in weedy or gravelly places.[†] Very variable. (*zonalis*, banded.)

*Pœcilichthys zonalis*, Cope, Journ. Ac. Nat. Sci. Phila., 1868, 212, Holston River, Virginia. (Coll. Cope.)

*Nanostoma vinctipes*, Jordan, Proc. U. S. Nat. Mus., 1879, 236, tributary of Illinois River, Naperville, Illinois, (Type, No. 23454. Coll. E. R. Copeland); females with barred ventrals.

*Astatichthys zonalis*, Vaillant, Recherches, 110, 1873.

*Nanostoma zonale*, Jordan & Gilbert, Synopsis, 510, 1883.

*Etheostoma zonale*, Gilbert, Proc. U. S. Nat. Mus., 1887, 54; Boulenger, Cat., i, 83.

Represented southwestward by

### 1461a. ETHEOSTOMA ZONALE ARCANSANUM, Jordan & Gilbert.

This form differs from the typical form, in having the breast nearly or quite naked. Found in the Ozark region of Missouri and Arkansas.

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[*] The specimens from Mississippi called *Nanostoma zonale* by Hay, seem to be the female of his *elegans.*

[†] A specimen in the Museum of Comparative Zoölogy from Delaware River apparently belongs to *Etheostoma zonale.* It is very deep in body, the depth 4⅖ in length, equal to length of the short head; scales 53. There is no other record of the species from this region and the locality may be doubtful.

*Etheostoma zonale arcansanum*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1886, 5, Spring River, Carthage, Missouri; James River, Marshfield, Missouri; Poteau River, Hackett City, Arkansas; Washita River, Arkadelphia, Arkansas, and Saline River, Benton, Arkansas. (Type, Nos. 36249, 36275, 36399, 36410, 36447. Coll. Jordan & Meek.)

### Subgenus NOTHONOTUS, Agassiz.

### 1462. ETHEOSTOMA CAMURUM* (Cope).

(BLUE-BREASTED DARTER.)

Head 4; depth 4½. D. XI–13; A. II, 8; scales 7–50 to 58–8, 48 to 53 pores. Body stout; head short; muzzle abruptly decurved, the mouth somewhat inferior, lower jaw included; caudal broad, truncate. Males very dark olive or blackish, with an obscure band of a paler shade; belly paler; breast and throat deep rich blue; sides profusely sprinkled with crimson dots; these spots are sometimes arranged in short longitudinal series of threes and fours; series of olivaceous lines along the rows of scales; first dorsal with a black spot at base in front and a crimson one on the margin between the first and second rays; second dorsal, caudal, and anal crimson, bordered with yellow, which again is bordered with black or dark blue on the edge of the fin; the crimson is deepest next the yellow; pectoral and ventral fins with a broad red margin. Females less distinctly marked; greenish; many scales brown; fins yellowish olive; caudal red; all vertical fins edged with blackish. Specimens from the Tippecanoe River, Indiana (Coll. Evermann), have the following life colors: Sides light brown, with 12 to 15 very narrow greenish lines running from pectorals to caudal; three rather plain vertical bars of the same color, but much broader just back of the pectorals, faint traces of 5 or 6 others between them and the tail; about 50 to 60 small deep orange spots scattered irregularly over the sides; axils dusky; belly pale bluish green; throat and chin deeper blue; top of head and cheeks light brown, more or less mottled with darker; spinous dorsal uniform light brown, or greenish; soft dorsal deeper brown, with a series of reddish spots near the top; above these a pale line, above which is a still darker line, forming the border of the fin, and same as soft dorsal; pectorals pale brown, darkest on outer half; ventrals same, but outer half a little darker than pectorals; caudal light brown with some dark near the middle, a reddish brown bar near the tip; outside this a pale bar, the extreme tip of the fin being a pale green. Scales 53; snout bluntly decurved. Length 2½ inches. Indiana and Ohio to Tennessee in clear, swift waters; not common; one of the most elegant members of this most beautiful genus, perhaps the prettiest of fresh water fishes. (*camurus*, blunt-headed.)

*Pœcilichthys camurus*, COPE, Proc. Am. Philos. Soc. Phila., 1870, 265, head waters of the Cumberland River in Tennessee. (Coll. Cope.)

*Nanostoma camurus*, JORDAN & GILBERT, Synopsis, 506, 1883.

*Etheostoma camurum*, JORDAN, Bull. U. S. Fish Comm., VIII, 1888 (1890), 160; BOULENGER, Cat., I, 69.

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*A more beautiful fish than the Rainbow Darter, one of the very handsomest of them all, is the Blue-breasted Darter, *Etheostoma camurum.* It is a deep olive-green little fish, sprinkled over with dots of carmine like a brook trout. Its breast is of a deep ultramarine blue, and its fins gayly variegated with blue, yellow, and crimson. But we hardly learned to know it as an aquarium acquaintance, for we found it but twice, both times in the clearest of water, and our specimens never survived confinement more than two or three hours. We can only say of their habits that they died where other darters lived, and that before they died all other fishes seemed cheap and common beside them.—*Jordan & Copeland.*

### 1463. ETHEOSTOMA VULNERATUM (Cope).

Head 4; depth 4½. D. XIV–13; A. II, 8; scales 8–53–9. Body fusiform, stout; caudal peduncle very deep; dorsal outline scarcely arched; top of head gently and regularly curved to the end of the muzzle; orbit four times in length of head, equal to muzzle; first dorsal not low; caudal truncate, rounded; anal small; scales small. Color light olive, with about 8 vertical dark olive bars on the sides, which are interrupted above the lateral line; a few irregular crimson dots on the sides. Fins uniform, transparent, except the first dorsal and caudal; the former has a median series of red spots, the latter is pale orange, with a black margin; no cross bars on fins in the male; second dorsal with a black margin. Length 2 inches. French Broad River. This is probably the young of *Etheostoma camurum*, as Dr. Gilbert has indicated. The number of dorsal spines is, however, greater than we have seen it in *camurum* and we leave it for the present as a distinct species. (*vulneratus*, wounded.)

*Pœcilichthys vulneratus*, Cope, Proc. Am. Philos. Soc. Phila., 1870, 266, tributary of French Broad River, Warm Springs, North Carolina. (Coll. Cope.)

*Nothonotus vulneratus*, Jordan & Gilbert, Synopsis, 508, 1883.

### 1464. ETHEOSTOMA MACULATUM, Kirtland.

Head 3¾ to 4; depth 4⅔ to 5¼. D. XII–12 or 13; A. II, 8 or 9; scales 9–56 to 63–14, pores 57. Body elongate, with dorsal line not elevated, and the caudal peduncle very deep. Head acuminate, the front descending very gradually, the mandible rising as gradually to its extremity; orbit rather large, equal to snout, 4 to 4½ in head; end of maxillary reaching front of pupil; jaws subequal; teeth of outer row larger. Lateral line complete; cheeks naked; opercles scaly; opercular spine strong. Fins generally, especially the caudal, short, latter slightly rounded; first dorsal long; first anal spine very large. Pectoral shorter than head; gill membranes separate. Coloration above black, shading to dark olive below and with a narrow, wavy, leather-colored dorsal band; throat turquoise blue; sides and dorsal region marked with small circular spots of bright crimson, irregularly disposed, and in considerable number; first dorsal uncolored, with a black spot at base anteriorly and a dark shade through the middle; second dorsal blood red, without border; caudal with two large crimson spots confluent on the middle line of the tail at its base, without border; pectorals and ventrals not red-bordered; females dull, with the fins black barred and not crimson. Length 2½ inches. Northern Ohio and Indiana southward through Kentucky and Tennessee to northern Alabama, generally rare; most common in tributaries of the Wabash, Ohio, Cumberland, and Tennessee rivers; found in clear, swift water; one of the most beautiful species. (*maculatus*, spotted.)

*Etheostoma maculata*, Kirtland, Jour. Bost. Soc. Nat. Hist., 1840, 276, Mahoning River, Ohio, (Coll. Kirtland); Boulenger, Cat., I, 68.

*Pœcilichthys sanguifluus*, Cope, Proc. Amer. Philos. Soc. Phila., 1870, 264, head waters of the South Fork of the Cumberland River, in Tennessee. (Coll. Cope.)

*Boleosoma maculatum*, Vaillant, Recherches, 87, 1873.

*Nothonotus sanguifluus* and *maculatus*, Jordan & Gilbert, Synopsis, 507 and 508, 1883.

### 1465. ETHEOSTOMA CINEREUM, Storer.

Head 3½; depth 5½; eye 4 in head; snout 3⅙. D. XI or XII-11 to 13; A. II, 8; scales 8-57 to 60-9. Body slender, somewhat compressed; head pointed; profile from tip of snout to top of head regularly convex; mouth moderate, horizontal, low; upper lip on level with lower rim of orbit; maxillary reaching front of orbit; premaxillaries not protractile; gill membranes but slightly connected. Opercles scaled; cheeks, nape, and breast naked or with few embedded scales; scales small, firm, finely ctenoid, those on ventral line not enlarged; lateral line complete. Fins moderate; height of spinous dorsal about half length of head; soft dorsal somewhat higher, a little higher than anal; pectorals about 1¼ in head, reaching tips of ventrals. Color: Upper portion of body light yellow; back with 4 dark cross bars, the first and largest between the two dorsals, the next two in the base of the second dorsal, and the last upon the caudal peduncle; each scale above lateral line with a brown spot, these spots forming 2 or 3 lines running back to region of second dorsal; along the lateral line is a series of 11 or 12 oblong dark spots, continued forward across opercles and through the eye, meeting around the snout; top of head dark; entire under parts of body yellowish; dorsal fins speckled or mottled with brownish; spinous dorsal margined with red; second dorsal and anal variegated with red spots. Length 3½ to 4 inches. Tennessee and Cumberland rivers; rare, and only lately rediscovered by Doctor Philip H. Kirsch nearly fifty years after its original discovery; recorded from Tennessee River at Florence, Alabama, Obeys River at Olympus, Tennessee, and Rock Creek, near Whitley Station, Kentucky. A large and showy species. (*cinereus*, ashy gray.)

*Etheostoma cinerea*, STORER, Proc. Bost. Soc. Nat. Hist., 1845, 49, Florence, Alabama. (Coll. C. A. Hentz.)

*Etheostoma cinereum*, KIRSCH, Bull. U. S. Fish Comm., XI, 1891 (1893), 264, and 268; VAILLANT, Recherches, 68, 1873; BOULENGER, Cat., I, 82.

*Nothonotus cinereus*, JORDAN & GILBERT, Synopsis, 509, 1883.

### 1466. ETHEOSTOMA TESSELLATUM,* Storer.

D. XII-13; P. 13; V. I, 5; A. II, 10. Body oblong. Head gibbous, less than ¼ the length of the body. Lateral line straight. Top of the head and upper portion of the sides of a greenish-brown color; 8 or 10 transverse bluish bands on the sides; the intervals between these bands are yellowish, and in the center of each is a bluish rhomb; a black blotch at the base of the tail; the lips, opercles, and rays of the first dorsal gamboge-yellow. Length 3 inches. Florence, Alabama. Caught in running water. (Storer.) Not seen by any later collector, but apparently a valid species. (*tessellatus*, having spots, like mosaic.)

*Etheostoma tessellata*, STORER, Proc. Bost. Soc. Nat. Hist., 1845, 48, Tennessee River at Florence, Alabama. (Coll. C. A. Hentz.)

*Etheostoma tessellatum*, VAILLANT, Recherches, 68, 1873.

*Nothonotus tessellatus*, JORDAN & GILBERT, Synopsis, 509, 1883.

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* The name *tessellatus* is preoccupied in this genus, only if *Boleosoma* be merged into it.

### 1467. ETHEOSTOMA RUFILINEATUM (Cope).

Head 4; depth 4½ to 5. D. X to XII–11 to 13; A. II, 8 or 9; scales 6–45 to 48–7. Stout, the dorsal line elevated and descending regularly from the base of the first dorsal to the end of the muzzle. Muzzle short, regularly conic, about equal to eye, which is smaller than usual, 4½ in head. Premaxillaries not protractile; gill membranes not united across the isthmus. Pectoral as long as head; lateral line complete. Dorsal well developed; caudal peduncle deep; caudal fin small, truncate. Scales large; cheeks, nape, and breast naked, opercles scaled. In life, male, green, the body with longitudinal stripes, each as wide as one row of scales, and formed by darker edges of the scales; some of the scales with center spots of bright orange brown; usually from 2 to 6 consecutive scales in each series orange brown, then an equal number olive, the olive and orange areas irregularly alternating; head with an olive-black band through snout to nape; an interrupted band below this, still lower 2 blackish spots; usually about 5 black dashes on each side of head, a characteristic color mark; angle of mouth orange; lips orange, except in front; lower jaw with an orange spot; interopercle, opercle, cheek, and first three branchiostegals each with orange spots; belly orange yellow; breast deep blue; fins all bordered with scarlet, a very narrow blackish edge and a narrow pale streak between it and the scarlet; spinous dorsal straw color, dotted with black and edged with orange; second dorsal similar, more yellow; caudal scarlet, its center yellow, its base with a large blue-black spot, which extends into the yellow; base of caudal yellow, an orange spot above and below; anal bright yellow at base, then scarlet, with narrow pale and dark edgings; ventrals similar; pectorals yellow, with a blackish and a scarlet crescent at base and a subterminal scarlet band. Females green with 8 faint dark cross bars, obscure and interrupted; scales on sides with yellow streaks arranged like the brown streaks on the male; fins all yellow; anal and ventrals tinged with orange; pectorals tinged with orange anteriorly, all the fins with bars or dark spots; caudal blackish, its base yellow; head with black markings similar to those on the male, but without scarlet. Length 3 inches. Upper tributaries of the Tennessee, Cumberland, and Green rivers; very abundant in clear brooks and pools; one of the most gaudy of darters. (*rufus*, reddish; *lineatus*, lined; properly spelled *rufolineatum*.)

*Pœcilichthys rufilineatus*, COPE, Proc. Amer. Philos. Soc., 1870, 267, Warm Springs Creek, French Broad River, Madison County, North Carolina. (Coll. Cope.)

*Nothonotus rufilineatus*, JORDAN & GILBERT, Synopsis, 508, 1883.

*Etheostoma rufolineatum*, JORDAN, Bull. U. S. Fish Comm., VIII, 1888 (1890), 149; BOULENGER, Cat., I, 69.

### 1468. ETHEOSTOMA JORDANI, Gilbert.

Head 3½ to 3¾; depth 4¾ to 5. D. X or XI–10 to 12; A. I, 7 or 8; scales 43 to 55 (averaging 48). Closely related to *Etheostoma rufilineatum*, from which it differs conspicuously in form and coloration. Body rather deep, compressed, the caudal peduncle slenderer than in related forms, the anterior profile much more convexly decurved, the snout blunter. Mouth terminal, oblique, rather small, the maxillary scarcely reaching vertical from front of pupil, 3⅗ in head; premaxillaries on level of lower margin of orbit, the jaws about equal. Eye equaling snout, 4⅓ to 4½ in head, twice interorbital width. Preopercle entire. Gill membranes not united. Spinous dorsal high, the spines strong, the membrane from last spine not joining base of soft dorsal; highest dorsal spine slightly more than half length of head; base of soft dorsal 1½ in base of spinous dorsal; anal shorter than soft dorsal and inserted more anteriorly, the first spine longer and stronger than the second, ⅔ the height of longest anal ray and ⅓ length of head; caudal fan-shaped when widely spread; pectorals reaching beyond tips of ventrals, 1¼ in head; ventrals extending half way to base of second anal spine. Scales large, strongly ctenoid, present on nape, the breast naked; opercles scaly, head otherwise naked. No enlarged black humeral scale. Lateral line complete or wanting on occasional scales in its course, straight. Colors probably brilliant in life. In spirits, the males are olivaceous, darker above, the sides with faint, narrow longitudinal dark lines running between the rows of scales; back with 8 black cross bars wider than the interspaces, the first on nape, the second under and in advance of origin of spinous dorsal, the fifth under first rays of soft dorsal; the first bar continued downward into axil of pectorals, the others usually not reaching lateral line; middle of sides with irregular bars, usually formed of disconnected blotches, and 9 or 10 in number; a pair of black blotches at base of median caudal rays and sometimes a pair at base of outer rays; fin rays all blackish, the membranes lighter; basal half of anterior portion of spinous dorsal black, its margin narrowly white, a narrow submarginal dark line below it. Soft dorsal and caudal with a wide white (probably orange in life) submarginal band, the tips narrowly black; anal and ventrals similar, but without black margin; pectorals uniform dusky, with light membranes; snout and top of head blackish; a small black spot behind eye; fins probably blue and orange in life. Females mottled, with fins barred. Tributaries of the Coosa River in the Alabama River basin; locally abundant. (Named for David Starr Jordan.)

*Etheostoma* (*Nothonotus*) *jordani*, GILBERT, Bull. U. S. Fish Comm., IX, 1889 (1891), 156, plate 43, fig. 3, Choccolo Creek, Oxford, Alabama, and Chestnut Creek, Verbena, Alabama. (Coll. Kirsch.)

*Etheostoma jordani*, BOULENGER, Cat., I, 70.

### Subgenus TORRENTARIA, Jordan & Evermann.

### 1469. ETHEOSTOMA SAGITTA, Jordan & Swain.

Head 3⅕; depth 4⅘. D. X–13; A. I, 10; scales about 68 (48 tubes). Body rather slender, compressed, the back a little elevated, the caudal peduncle rather long and not very deep. Head very long and slender, eel-like, tapering forward to a sharp snout, its depth at the pupil about ⅓ its length. Interorbital space narrow. Snout about as long as eye, 5 in head. Mouth very large for the genus, oblique, the maxillary reaching to below front of pupil, 3¼ in head. Jaws subequal in front, upper jaw not protractile; teeth rather strong. No scales on cheeks, opercles, or breast; nape covered with small scales. Opercular spine well developed. Gill membranes scarcely connected. Scales on body small, firm, ctenoid; a small, black humeral process. Lateral line nearly straight, becoming obsolete under last rays of second dorsal; belly covered with ordinary scales. Dorsal spines slender, rather high; soft dorsal rather higher, its base shorter; anal nearly equal to soft dorsal, its base somewhat shorter, its rays a little higher; anal spine slender, single in the typical example, the normal number probably 2; caudal truncate, 1⅓ in head, about as long as the ventrals, which are rather shorter than the pectorals. Color in life dusky green, with markings of darker olive, the latter forming about 9 obscure cross bars, which are about as wide as the interspaces, these most distinct posteriorly and below the lateral line; a dusky spot at base of caudal; a roundish orange spot in each of the pale interspaces between the bars along the sides; some minute orange spots above the lateral line; a narrow black streak along side of head through eye; a pink spot in front of eye above; snout tinged with orange; first dorsal translucent, with a narrow edge of orange; soft dorsal translucent, speckled with dusky and pale orange; tail with 3 or 4 alternate bars of orange and dusky olive, the marking not very sharp; pectorals similarly, but more faintly, marked, orange at base; anal and ventrals colorless. Breast not blue nor orange. Length 2½ inches. Head waters of Cumberland River; only the single type known, perhaps the type of a distinct genus. (*sagitta*, an arrow.)

*Pœcilichthys sagitta*, JORDAN & SWAIN, Proc. U. S. Nat. Mus., 1883, 250, Wolf Creek, a tributary of South Fork of the Cumberland, near Pleasant View, Whitley County, Kentucky. (Coll. Jordan & Swain.)

*Etheostoma sagitta*, BOULENGER, Cat., I, 88.

### 1470. ETHEOSTOMA AUSTRALE, Jordan.

Head 3½ to 3¾; depth 4¼ to 4⅔. D. X to XII, 9 to 11. A. I, 7 or 8; scales 6–58 to 66–11, pores 34 to 44. Form of *Etheostoma cæruleum*; mouth rather small, the lower jaw included; maxillary reaching front of pupil; eye small, about as long as the sharp, pointed snout, 4 to 4½ in head; gill membranes moderately connected; cheeks, opercles, nape, and breast naked; lateral line incomplete; a well-marked black humeral scale. Fins in males rather high; anal fin with a single spine (in all the numerous specimens examined), this spine long and quite strong. Pectoral as long as head; caudal rounded. Color in spirits: Males with about 10 dusky cross bars, with pale interspaces, perhaps red in life, these alternating with pale blotches on back; a dark spot below eye and a dark humeral scale; soft dorsal and caudal barred. Female specimen (with eggs) speckled, with dark cross blotches on back; scales punctulate. Length 2 inches. Chihuahua River, Mexico, in the Rio Grande Basin; locally common. (*australis*, southern.)

*Diplesion fasciatus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 101, Chihuahua River, Mexico; not *Catonotus fasciatus*, GIRARD, also an *Etheostoma*.

*Etheostoma australe*, JORDAN, Proc. U. S. Nat. Mus., 1884, 362, Chihuahua River, Mexico (substitute name, description taken from the types of *Diplesion fasciatus*, GIRARD); EVERMANN & KENDALL, Bull. U. S. Fish Comm., XII, 1892 (1894), 115; BOULENGER, Cat., I, 88.

*Etheostoma scovellii*, Woolman, American Naturalist, March, 1892, 261, Rio de las Conchas, Chihuahua, Mexico. (Coll. the Scovell Orizaba Expedition.)

### Subgenus NIVICOLA, Jordan & Evermann.

### 1471. ETHEOSTOMA BOREALE (Jordan).

Head 3⅗; depth 5⅖; eye 4 in head. D. VIII–9; A. II, 7; scales 4–53–10; lateral line with pores on 15 scales. Body moderately elongate, somewhat compressed, the caudal peduncle rather long and stout, the general form resembling that of *Etheostoma artesiæ* and *E. punctulatum*. Head rather heavy, the snout bluntish, rather strongly decurved. Anterior profile gently and somewhat evenly arched. Snout short, about half as long as eye. Mouth nearly horizontal, the lower jaw included, the maxillary extending about to opposite front of pupil, its length 3⅔ in head. Teeth small. Preopercle entire; opercular spine strong. Premaxillary not protractile. Gill membranes very slightly connected, A small black humeral scale; cheeks, opercles, and nuchal region scaly; breast naked; scales of moderate size; lateral line very short, not reaching last spine of dorsal, running rather high and slightly arched. Scales of belly like those of the sides. Dorsal fins well separated, unusually short and small; the longest spine in the largest example (♀ ?) 3½ in head, in another one (♂ ?) 2⅔ in head; soft dorsal a little higher than spinous dorsal, also unusually small for this genus; caudal long, truncate, or slightly lunate, 1½ in head; anal low and short, its spines high, the first highest; pectorals nearly as long as head, reaching past tips of ventrals. Color in spirits: Male, dark gray (perhaps red in life) somewhat mottled with darker; sides with 11 or 12 very distinct vertical dark cross bands (probably blue in life), each alternate, one usually extending across the back, meeting its fellow of the opposite side; a dark saddle-like blotch on back between dorsal fins; a dark bar before, behind, and below eye, radiating from eye, the suborbital bar most distinct; head with dark dots; spinous dorsal with a submedian broad dark band (otherwise pale); soft dorsal and caudal sharply barred with darker; about 5 dark bars across caudal; pectoral more faintly barred; lower fins pale, plain. Another specimen, probably a female, is paler and grayer, with the cross bars narrower and less regular; the markings on the fins are much paler, the first dorsal being without dark longitudinal band. Length 2½ inches. Montreal, Canada; only the type known. (*borealis*, northern.)

*Pœcilichthys borealis*, Jordan, Proc. U. S. Nat. Mus., 1884, 477, Montreal, Canada. (Type, No. 35747. Coll. T. J. Doran.)

*Etheostoma boreale*, Boulenger, Cat., i, 78.

### Subgenus RAFINESQUIELLUS, Jordan & Evermann.

### 1472. ETHEOSTOMA POTTSII (Girard).

Head 3½ to 3⅔; depth 3¾ to 4. D. IX to X–1, 10 to 12; A. II, 7 or 8; scales 5–44 to 50–10, pores 23 to 31. Length of caudal peduncle nearly equaling head. Least depth caudal peduncle equals ½ head. Body extremely short and deep, the head short and heavy, moderately compressed. Upper profile of head rounded, no angle above orbits, the short snout with rounded profile, but not obtuse. Premaxillaries on level of pupil, nonprotractile. Preorbital extremely narrow, little wider than the broad end of the maxillary bone, which is not concealed by it. Gill membranes rather narrowly united across the isthmus, their width anteroposteriorly ½ diameter of eye. Opercular spine bifid, with 2 minute free points. Preopercle entire. Eye large, 4 in head to end of opercular spine. Interorbital space wide, strongly convex, its width equaling length of snout, 5⅓ in head. Fins all small; distance from front of dorsal to tip of snout ⅓ length; dorsals low, the 2 joined at base, the last spine appearing longer than the preceding one and belonging to the second dorsal; longest dorsal spine ⅓ head; length of last dorsal spine ⅔ diameter of orbit, the spine erect and connected for its entire height with the following soft ray; the next to the last spine directed very obliquely backward, and appearing much shorter than the last spine, its membrane joining last spine at base only; base of spinous dorsal as long as head in front of preopercular margin, its highest ray half head; anal fin very small, the spines large and strong, first spine much longer and stronger than the second, 3⅓ in head, equaling length of snout and half eye; highest soft ray of anal equaling length of snout and eye; pectorals and ventrals both very small; the pectoral short, broad, and rounded, reaching the same vertical as ventrals, 1⅓ in head, and having but 11 rays; ventrals close together, 1½ in head. Sides of head, breast, and nape wholly naked; body with rather large, ctenoid scales, uniformly covering belly; lateral line straight, incomplete, reaching to below middle of soft dorsal. Color in spirits: Light olive, sides and above obscurely tesselated with darker; nine short dark cross bars on back, and traces of about an equal number on middle of sides, those on front of sides faint, only the last 5 evident; a black humeral spot present; a faint dark streak downward and 1 forward from eye, and a small dark spot above and behind orbit; cheeks dusky; top of head vermiculated with dusky brownish; spinous dorsal with a basal series of small blackish spots, each in the midst of a translucent area, the terminal portion of membrane rendered dusky by minute close-set dark points; soft dorsal and caudal barred with light and dark lines; pectorals and ventrals translucent, unmarked. Length 1¾ inches. Streams of Chihuahua, Mexico; an aberrant species of darter, looking like a young bass. (Named for John Potts of Chihuahua, its discoverer and an "esteemed friend" of Dr. Girard.)

*Aplesion pottsii* (missprinted *potsii*), GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 102, tributaries of Chihuahua River. (Coll. John Potts.)

*Etheostoma micropterus*, GILBERT, Proc. U. S. Nat. Mus., 1888, 289, Chihuahua, Mexico; EVERMANN & KENDALL, Bull U. S. Fish Comm., XII, 1892 (1894), 115, pl. 35.

*Boleosoma pottsii*, VAILLANT, Recherches, 94, 1873.

*Etheostoma pottsii*, BOULENGER, Cat., I, 74.

### Subgenus OLIGOCEPHALUS, Girard.

#### 1473. ETHEOSTOMA IOWÆ, Jordan & Meek.

Head 3⅘ to 4; depth 4 to 5½; eye 4 to 5 in head. D. VII to X-10 or 11; A. II, 6 to 8; scales 5–55 to 63–11, pores 20 to 34. Body rather more elongate than in *Etheostoma jessiæ*; the caudal peduncle rather long and slender. Head moderately acute, the snout a little decurved, its length rather less than eye. Mouth small, nearly horizontal, the lower jaw included, the maxillary reaching to opposite front of eye, its length 4 in head. Teeth rather small. Opercular spine strong. Gill membranes scarcely connected. No black humeral scale. Cheeks, opercles, and nape more or less closely scaled; breast naked; top of head without scales; scales smaller than in *E. jessiæ*; lateral line straight, ceasing near the middle of the body. Fins all low, the spines slender. Dorsal fins well separated, caudal subtruncate; pectorals 1⅙ to 1¼ in head. Fin rays unusually variable. Color in life: Light green, finely blotched with darker; dark-green blotches on opercle; a dark stripe below eye; sides with 10 or 11 reddish spots interspersed among darker bands; spinous dorsal with a narrow dark margin, below this a darker band and then a red one; soft dorsal, caudal, and pectorals irregularly barred with yellow and with greenish specks. Length about 2 inches. Upper Mississippi Valley from Iowa and Nebraska, north to Assiniboia; common northwestward, many specimens having been taken by Dr. Eigenmann from Swift Current River in the Saskatchewan Basin, and from Fort Qu' Appelle in the basin of the Red River of the North, this last being the most northern point at which any species of darter has yet been found. Dr. Meek records it as abundant in Storm and Spirit lakes in Iowa, and in the State Fish Commission ponds at South Bend, Nebraska. It is the most common darter in Nebraska and South Dakota (Evermann & Cox), its range extending as far west as Valentine, Nebraska (longitude 100° 30′ W.), the most westerly point at which any member of the family has yet been found in the Missouri Basin.

*Etheostoma iowæ*, Jordan & Meek, Proc. U. S. Nat. Mus., 1885, 10, Chariton River, Chariton, Iowa, (Coll. Jordan & Meek); Eigenmann, Bull. U. S. Fish Comm., xiv, 1894, 117; Meek, Bull. U. S. Fish Comm., xiv, 1894, 138; Evermann & Cox, Rept. U. S. Fish Comm., xviii, 1895.

*Etheostoma quappella*,* Eigenmann & Eigenmann, American Naturalist, November, 1892, 963, Qu' Appelle River, Fort Qu' Appelle, Manitoba, (Type in Brit. Mus. Coll. Eigenmann); Eigenmann, Bull. U. S. Fish Comm., xiv, 1894, 117.

*Etheostoma ioæ*, Boulenger, Cat., i, 72.

*Etheostoma quappellæ*, Boulenger, Cat., i, 74.

### 1474. ETHEOSTOMA JESSIÆ (Jordan & Brayton).

Head 4; depth 4¾ to 5. D. X to XII–12 to 14; A. II, 7 or 9; scales 6–47 to 55–8, lateral line usually but not always incomplete, pores developed on about 35 to 38 scales. Body fusiform, rather deep and compressed; head rather large and moderately pointed; mouth rather large, terminal, upper jaw slightly the longer. Cheeks usually closely scaled, sometimes almost naked; opercles scaled; nape scaled; breast naked. Fins moderate. Chestnut-colored above, with about 9 quadrate bar-like blotches of dark greenish along the sides, and about 5 dark cross blotches on back; body usually covered with dark dots; fins mottled with chestnut; spinous dorsal with an orange-red bar across it near the edge; second dorsal and anal speckled with golden, or with dark cross streaks. Texas specimens with 3 dark spots at base of caudal, the median one most distinct. No dark humeral spot; lower fins dusky. Length 1¾ inches. Indiana to Iowa and south to Mississippi and Texas; widely distributed but not very common anywhere; perhaps more than 1 species included here, as the types of *jessiæ*, *asprigene* and *swaini* differ in form and coloration. Only the form *asprigene* is well known as yet. (Named for Mrs. Jessie Dewey Brayton.)

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* This nominal species was described as follows:

Head 3⅔ to 4; depth 5 to 5½; dorsal IX–9 or 10; anal II, 7, scales 3–53–10; pores 19. Eye very large, much longer than snout, 3½ in head; jaws subequal. Premaxillaries not protractile; gill membranes scarcely connected; cheeks and opercles with a few scales; ventral line with the median scales not enlarged; lateral line straight; palate without teeth; anal fin considerably smaller than soft dorsal; humeral region without black scale; cheeks with a few scales just below and behind eye; opercle with a few scales on its upper angle. Pectorals 1½ in head; caudal rounded. Color pale olive, with a lateral series of ill-defined large darker spots; in life with about 8 dark-blue bars on side; alternating with rusty bars; dorsal and caudal fins barred. Qu' Appelle River, a tributary of Assiniboine River, at Qu' Appelle, Assiniboia; one specimen known, 44 mm. long. (Eigenmann; Boulenger). This is the northernmost point from which Darters have been obtained. This species is very close to *Etheostoma iowæ* and may not be different. (*qu' appelle*, what calls? ; name of a river tributary to the Assiniboine.)

*Pœcilichthys jessiæ*,[*] JORDAN & BRAYTON, in Jordan's Man. Vertebrates, Ed. 2, 227, 1877, and in JORDAN, Bull. U. S. Nat. Mus., XII, 1878, 59, Chickamauga River, Ringgold, Georgia, (Coll. Jordan); JORDAN & GILBERT, Synopsis, 518, 1883.

*Pœcilichthys asprigenis*,[†] FORBES, Bull. I, Ill. Lab. Nat. Hist., 41, 1877, small creek at Pekin, Illinois. (Coll. Forbes.)

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[*] The following is the original description of *Pœcilichthys jessiæ*, Jordan & Brayton:

Body fusiform, rather deep and compressed, the depth 5 to 5½ in length, the form of the body similar to that of *P. spectabilis*. Head rather large, moderately pointed, 4 in length; mouth rather large, terminal, the upper jaw slightly longest, not protractile. Eye pretty large, high up, 3½ in head, about equal to snout. Cheeks naked, scaly above; opercles scaly; throat naked; neck above scaly; scales medium, 6–45 to 50–7. Lateral line incomplete, but extending farther than *P. variatus* and *P. spectabilis*, on about 35 scales, or nearly to the end of the second dorsal. Fins moderate. Dorsal XII–about 12. Anal II, 9. Color in spirits, olivaceous, with about 9 squarish, bar-like blotches along the sides and about 5 cross blotches on the back. Dorsal and caudal fins faintly barred. In life, the fish is chestnut-colored above and the squares on the sides are bright dark blue; the fins are mottled with chestnut. A dark yellow or orange band across the dorsal. Second dorsal and anal with dark and golden specklings. Several specimens, each about 2 inches long, taken in Chickamauga River at Ringgold. The specimens are certainly not fully grown, and the coloration of the adult male is doubtless much more brilliant. It will be distinguished at once from *P. variatus* (= *cœruleus*) and *P. spectabilis* by the scaliness of the upper part of the cheeks, by the greater development of the lateral line, the more numerous dorsal spines, and the coloration. This species is named for Mrs. Jessie D. Brayton..—*Jordan & Brayton.*

[†] The following is the original description of *Pœcilichthys asprigenis*, Forbes:

Head 3¾ to 4; depth 4¼ to 4¾ in length, eye in head 3½ to 4; nose about ⅔ the eye. Width at pectorals 8 to 10 in length; at middle of second dorsal 12 to 15. The caudal peduncle is twice as long as high. Longitudinal rows ⅝. Breast always naked, opercle wholly scaly, back wholly scaled before the dorsal, or a narrow strip left bare. The first dorsal consists of from 9 to 12 spines; its height is from ½ to ⅓ its length, and ⅔ the height of the second dorsal. The latter contains from 10 to 12 rays, of which, in one case, the first was a stout, sharp spine (XI–I, 11); its length is ⅔ that of the first, and ⅗ greater than that of the anal. The anal consists of 2 spines and 7 or 8 soft rays, the longest ray reaching to the middle of the caudal peduncle. Fourteen specimens examined; taken in small creek near Pekin, Illinois. Among some specimens from Pekin, Illinois, whose label as *Pœcilichthys spectabilis* had apparently served to disguise them, I observed a number with scaly cheeks. Dr. Jordan has decided that these are neither *spectabilis* nor *jessiæ*, and I have therefore described the series as a new species, although the wide variation of so-called specific characters presented by them suggests that several species of this genus may ultimately have to be merged. I have not been able, however, with a large number of specimens, to trace the one wholly into the other, and I therefore leave them distinct for the present. General appearance much like that of *P. spectabilis*, from which it differs in the scaly cheeks, the more complete lateral line, and the greater number of vertical rows of scales. In *spectabilis* the cheeks are either wholly bare or a few scales appear behind and below the eye. In *asprigenis* they are either wholly covered or naked only on the lower fourth. The vertical rows vary in my specimens of *spectabilis* from 38 to 43 (counting only complete rows), in *asprigenis* from 48 to 50. In the former, the lateral line extends over from 25 to 31 scales, in the latter from 34 to 41. The head is small and pointed, the eye large (longer than snout), the outlines regularly curved, the body compressed and rather deep, the mouth terminal, oblique, and the jaws about even. The dorsal fins are sometimes separated by distances varying from the length of half a scale to a scale and a half, but are occasionally quite continuous, the two being united by membrane. Length 35 to 45 millimeters.

*Pœcilichthys swaini*,‡ JORDAN, Proc. U. S. Nat. Mus., 1884, 479, tributary of Pearl River, Monticello, Mississippi. (Type, No. 35308. Coll. Jordan & Swain.)

### 1475. ETHEOSTOMA LUTEOVINCTUM, Gilbert & Swain.

Head $3\frac{2}{3}$ to 4; depth $4\frac{1}{2}$ to 5; eye $3\frac{1}{2}$ to 4 in head. D. IX or X–13; A. II, 7 or 8; scales 6-49 to 55–11. Body compressed, the back elevated, the profile descending rapidly forward, and gradually toward tail, from front of spinous dorsal; caudal peduncle very slender. Head compressed, with a short high snout, the upper profile of which descends in a strong curve. Mouth at lower level of muzzle, which does not project beyond it, mandible included. Gape nearly horizontal, of moderate size, the maxillary reaching vertical from front of pupil, $3\frac{1}{2}$ in head. Cheeks and opercles scaled. Preopercle entire. Opercular spine present. Branchiostegal membranes narrowly joined across isthmus. Eye rather large, longer than snout. Dorsals short and low, well separated from each other; base of spinous dorsal equaling length of caudal peduncle and but little longer than that of soft dorsal; highest dorsal spine half length of head; the highest soft ray $1\frac{2}{3}$ in head; anal spines of about equal length, both slender and rather high, $\frac{1}{3}$ length of head; pectorals as long as head; ventrals $1\frac{2}{7}$ in head. Cheeks, opercles, and nape closely scaled, the breast naked or partially scaled; no black humeral scale; lateral line nearly straight, continued to below middle of second dorsal, running on 30 to 35 scales. Colors in life: Very light pale olive, with 7 dusky cross bars on back, narrower than the interspaces and reaching about halfway to lateral line, their ends connected by dusky lines; below lateral line about 9 dusky greenish blotches, between which are orange-yellow cross bars, most distinct posteriorly, not reaching median ventral line; no distinct streak forward from eye; a dusky bar below eye; snout dusky; small black spots at base of caudal; soft dorsal and caudal barred with dusky; spinous dorsal with a black blotch on posterior rays, a yellow or orange bar through middle of fin, the base and margin dusky; anal fin unmarked. Length 2 inches. Stone River, a tributary of Tennessee River; not common. (*luteus*, yellow; *vinctus*, banded.)

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‡ The following is the original description of *Pœcilichthys swaini*:

Head $3\frac{3}{5}$ in length; depth $4\frac{3}{5}$. D. XI, 12; A. II, 6; scales 3 or 4–41–7 or 8. Body fusiform, rather elongate, the back rather elevated anteriorly, the caudal peduncle moderate, somewhat compressed. Head rather slender and small, the anterior profile rather steep and gently curved, becoming more obtuse at the tip of the snout. Snout short, a little bluntish; its length 5 in head. Eye rather large, $3\frac{1}{2}$ in head. Mouth not very small, oblique, the lower jaw included; the maxillary reaching very nearly to opposite middle of pupil, its length $3\frac{1}{3}$ in head. Teeth rather strong, present on vomer. Preopercle entire. Gill membranes very nearly separate. Opercular spine strong. Opercles and cheeks well scaled; scales of body rather large, ctenoid; belly covered with ordinary scales; nuchal region nearly naked; breast naked; lateral line wanting posteriorly on about two scales, anteriorly somewhat arched and concurrent with the back. Dorsal fins contiguous but separate, both high, the soft dorsal shorter and higher than the spinous dorsal and much longer and higher than the anal; longest ray of soft dorsal $1\frac{3}{4}$ in head; caudal truncate, $1\frac{2}{3}$ in head; pectorals moderate, $1\frac{1}{10}$ in head, not quite reaching vent; ventrals coterminous with them, $1\frac{1}{3}$ in head. Color in spirits olivaceous, marbled with darker, the dark markings rather obscure and taking the form of dark quadrate spots about as large as the eye and alternating so as to give a checkered appearance. Head with 4 dark stripes, which radiate from the eye; a dark streak on anterior part of opercle; spinous dorsal with a basal band of pale (probably crimson in life), above this a dark band (probably deep blue); the outer edge of the fin broadly pale (probably scarlet in life); soft dorsal and caudal checkered with light and dark spots; anal and ventrals plain, apparently bluish, the latter darkest; pectorals plain; no black humeral spot. A single specimen, 2 inches long.

*Etheostoma luteovinctum*, GILBERT & SWAIN, Proc. U. S. Nat. Mus., 1887, 58, Stone River, near Nashville, Tennessee, (Coll. Gilbert & Swain); BOULENGER, Cat., I, 73.

### 1476. ETHEOSTOMA LEPIDOGENYS, Evermann & Kendall.

Head (including opercular flap) 4; depth 5; eye 4 in head; snout 4. D. X–12; A. II, 7 or 8; scales 7–54 to 61–9; lateral line straight and incomplete, 32 to 38 pores. Body moderately stout, head heavy, snout short, blunt, and decurved, back little elevated, caudal peduncle deep, its least depth 2 in head. Mouth rather small, but little oblique, lower jaw slightly included; premaxillary just reaching front of orbit, not protractile. Gill membranes scarcely united. Fins moderate; soft dorsal higher than spinous portion; pectoral short, only as long as head, not reaching beyond tips of ventrals; ventrals short, distance from their tips to origin of anal equaling half length of head; anal rather small, scarcely reaching tips of soft dorsal when depressed. Scales strongly ctenoid; cheeks densely scaled; opercles and breast entirely naked; nape scaled; median line of belly with ordinary scales, not deciduous. In the larger specimen, which is 2 inches long, there are on the right side 57 scales in a longitudinal series, upon 38 of which pores are developed, while upon the left side there are but 54 scales, upon 35 of which pores are developed. The second specimen, 1¾ inches long, has 61 scales upon the right side, with pores in 38 of them, and 55 upon the left, with only 35 developed pores. This shows a considerable variation, not only among individuals, but between the 2 sides of the same individual. Color in alcohol: Head dark above, sides pale, a dark line forward from eye to tip of snout and another broader one straight downward from the eye, broadest at lower end; a dark postocular spot followed by a fainter one on the opercle; dark humeral scale present; side of body with about 13 dark vertical bars, the first crossing over the back just in front of the spinous dorsal, the next 4 indistinct, except on back, where they widen into large blotches, the sixth crossing the back between the 2 dorsals; the seventh to tenth, inclusive, under the soft dorsal; the eleventh crosses just back of it, while the thirteenth is at the base of the caudal fin; spinous dorsal pale at base, next a broad dark band, then a narrow pale one, which is followed by a pale blue one (probably blue in life and) lastly, tipped with a very narrow margin of white; soft dorsal marbled or vermiculated with brown, the largest, plainest markings being at about ⅓ the distance from the tips of the fin; caudal like the soft dorsal, but the colors deeper; all the other fins unmarked. Length 2 inches. Rio Comal, Texas. Only the types known. (λεπίς, scale; γένυς, cheek.)

*Etheostoma lepidogenys*, EVERMANN & KENDALL, Bull. U. S. Fish. Comm., XII, 1892 (Feb. 6, 1894), 114, pl. XXXV, fig. 3, Rio Comal, New Braunfels, Texas, (Type, No. 44840. Coll. Evermann, Scovell, and Gurley); BOULENGER, Cat., I, 72.

### 1477. ETHEOSTOMA CŒRULEUM,* Storer.

(Blue Darter; Rainbow Darter; Soldier Fish.)

Head 3¾; depth 4¼; eye 4 to 4½ in head, little shorter than snout. D. IX to XII–12 to 14; A. II, 7 or 8; scales 5–37 to 50–10, usually 5–45–10, pores 18 to 35. Body robust, rather deep and compressed, the back somewhat elevated. Head large, compressed. Mouth moderate, terminal, oblique, the lower jaw somewhat included, the maxillary reaching front of orbit; opercular spine moderate; gill membranes not connected. Palatine teeth in one row. Cheeks naked or nearly so; opercles scaled; neck and breast usually naked. Fins all large; dorsal fins usually slightly connected. Anal spines subequal or the first a little the longer; caudal rounded; pectoral nearly or quite as long as head. Males olivaceous, tessellated above, the spots running together into blotches; back without black lengthwise stripes; sides with about 12 indigo-blue bars running obliquely downward and backward, most distinct behind, separated by bright orange interspaces; caudal fin deep orange, edged with bright blue; anal fin orange, with deep blue in front and behind; soft dorsal chiefly orange, blue at base and tip; spinous dorsal crimson at base, then orange, with blue edgings; ventrals deep indigo; cheeks blue; throat and breast orange; females much duller, with little blue or red, the vertical fins barred or checked; young variously marked, no dark humeral spot. Length 2½ inches. Mississippi Valley; very abundant in gravelly streams, and ascending small brooks. One of the most gorgeously-colored darters, but less graceful than most of them. The most common species in most parts of the Ohio Valley. (*cœruleus*, blue.)

*Etheostoma cœrulea*, Storer, Proc. Bost. Soc. Nat. Hist., 1845, 47, Fox River, Illinois. (Coll. S. C. Clark.)

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* Gayest of all the Darters, and indeed the gaudiest of all fresh-water fishes, is the Rainbow Darter (*Etheostoma cœruleum*). This is a litttle fish, never more than 3 inches long, and usually about 2. Everywhere throughout the northern parts of the Mississippi Valley it makes its home in the ripples and shallows of the rivers and in the shady retreats of all the little brooks. The male fish is greenish above, with darker blotches, and its sides are variegated with oblique bands alternately of indigo blue and deep orange, the orange often edged with patches of white. The cheeks are deep blue, the breast deep orange, while the expanded fins are gorgeous in scarlet, indigo, and crimson. The female, as is usually the case when the male of the species is resplendent, is plainly colored—a speckly green, with no trace of blue or orange. When the war of the rebellion broke out there were some good people who were anxiously looking for somes sign or omen, that they might know on which side the "stars in their courses" were fighting. It so happened that in a little brook in Indiana, called Clear Creek, some one caught a Rainbow Darter. This fish was clothed in a new suit of the red, white, and blue of his native land, in the most unmistakably patriotic fashion. There were some people who had never seen a Darter before and who knew no more of the fishes in their streams than these fishes knew of them, by whom the coming of this little "soldier fish" into their brooks was hailed as an omen of victory. Of course these little fishes had really "always been there." They were there when America was discovered and for a long time before, but the people had not seen them. The warblers lived, you remember, in Spalding's woods at Concord, but Spalding did not know that they were there, and they had no knowledge of Spalding. So with the Darters in Spalding's brooks. Still, when the day comes when history shall finally recount all the influences which held Indiana to her place in the Union, shall not, among greater things, this least of little fishes receive its little meed of praise? The Rainbow Darter is a chubby little fish, as compared with the other Darters. In its movements it is awkward and ungraceful, though swift and savage as a pike. One of the mildest of its tricks, which we have noticed, is this: It would gently put its head over a stone and catch a water boatman by one of its swimming legs, release it, catch it again and again release it, until at last the boatman, evidently much annoyed, swam away out of its reach. It will follow to the surface of the water a piece of meat suspended by a string. It is more alert in discovering this than a hungry sunfish or rock-bass, and it can be led around like a pet lamb by a thread to which is fastened a section of a worm.—*Jordan & Copeland.*

*Pœcilosoma erythrogastrum*, KIRTLAND, Cleveland Annals Science, 1854, 4, near Cleveland, Ohio. (Type, No. 1218. Coll. Kirtland.)

*Pœcilichthys versicolor*, AGASSIZ, Am. Journ. Sci. and Arts, 1854, 304, Quincy, Illinois. (Coll. Dr. L. Watson.)

*Pœcilosoma transversum*, ABBOTT, Proc. Ac. Nat. Sci. Phila., 1860, 826, Lake Superior.

*Astatichthys cœruleus*, VAILLANT, Recherches, 107, 1873.

*Pœcilichthys cœruleus*, JORDAN & GILBERT, Synopsis, 517, 1883.

*Etheostoma cœruleum*, MEEK, Bull. U. S. Fish Comm., 1891, 119, 131, 155; BOULENGER, Cat., I, 71.

Gradually passing from Indiana westward into the slight variety

### 1477a. ETHEOSTOMA CŒRULEUM SPECTABILE (Agassiz).

Head 4; depth 4½. D. X–12; A. II, 7; scales 5–40–7; lateral line on 20–25 scales. Very similar to *cœruleum*, but more elongate and rather more compressed; the colors similar, but the upper portion of the sides with distinct blackish stripes along the rows of the scales, and the ground color of the back and sides having a peculiar whitish or bleached appearance. The two dorsal fins usually well separated. Scales usually present below and behind eye. Length 2 to 3 inches. Mississippi Valley; rather less abundant than the other and ascending small or even muddy streams; not always to be distinguished with certainty from the preceding. Both occur in Indiana and Illinois, but the form called *spectabile* is the only one seen in streams of Missouri. (*spectabilis*, conspicuous.)

*Pœcilichthys spectabilis*, AGASSIZ, Amer. Journ. Sci. and Arts, 1854, 304, Osage River, Missouri, (Coll. Geo. Stolley); JORDAN & GILBERT, Synopsis, 518, 1883.

### 1478. ETHEOSTOMA LEPIDUM (Baird & Girard).

Head 4¼; depth 4⅗. D. IX–11 to 13; A. II, 6 to 8; scales 6–48 to 54–8, pores 27 to 36. Body rather stout, compressed, tapering backward. Head subconical. Mouth moderate, with equal jaws; maxillary reaching front of orbit. Eyes large. First dorsal rather low; dorsal fins somewhat connected. Head, as well as throat and neck, entirely scaleless. Color olivaceous, with some dark-blue bars; scales dusky at base, sometimes a slight trace of a humeral spot; dorsals and caudal mottled or barred. Length 2½ inches. Streams of Arkansas, Texas, and Chihuahua; common; apparently gradually passing into *Etheostoma cœruleum*, from which only the naked head separates it. Gilbert regards it as a subspecies of *cœruleum*. (*lepidus*, pretty.)

*Boleosoma lepida*, BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1853, 388, upper tributaries of the Rio Nueces. (Coll. Clark.)

*Oligocephalus grahami*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 102, Devil River, Texas. D. IX–13; A. II, 7. (Coll. Clark.)

*Oligocephalus leonensis*, GIRARD, *l. c.*, 102, Leon River, Texas. D. IX–10; A. II, 7. (Coll. Clark.)

*Oligocephalus pulchellus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 102, Gypsum Creek, a tributary to the Canadian River; A. II, 6. (Coll. Lieut. Whipple.)

*Boleosoma lepidum*, VAILLANT, Recherches, 90, 1873.

*Pœcilichthys lepidus*, JORDAN & GILBERT, Synopsis, 517, 1883.

*Etheostoma lepidum*, EVERMANN & KENDALL, Bull. U. S. Fish Comm., XII, 1892 (1894), 114; BOULENGER, Cat., I, 73.

### 1479. ETHEOSTOMA TIPPECANOE, Jordan & Evermann.

Head 4¼; depth 4¾. D. XII–12; A. II, 7; scales 5–50–8, with pores on about 23. Body rather robust, compressed, with deep caudal peduncle; head moderate, with pointed snout; eye small, as long as snout, 4½ in head; mouth large, oblique, the lower jaw somewhat included; maxillary reaching nearly to middle of eye; opercle very short, little longer than snout, its spine strong; cheeks naked, or with one or two scales above; opercles well scaled; breast naked; top of head naked; nape with fine scales; upper jaw not protractile; gill membranes nearly separate; lateral line straight, ceasing under front of second dorsal. Dorsals moderate, slightly connected; anal spines subequal; pectorals shortish, about as long as head; caudal short, subtruncate. Color dark, the scales covered with fine punctulations; body with 12 dark (probably blue in life) cross bands, nearly vertical and narrower than the interspaces, the next the last one brightest and broadest; between this and the last, two bright spots (probably red in life) with a dark one between them, at base of caudal; a black humeral scale; first dorsal dark; second dorsal, anal, caudal, and pectorals barred; ventrals speckled; three dark streaks diverging from eye; interspaces on sides probably more or less red in life. Length 1½ inches. Tippecanoe River, Indiana; but few specimens known; possibly a variation of *Etheostoma jessiæ*.

*Etheostoma tippecanoe*, JORDAN & EVERMANN, Proc. U. S. Nat. Mus., 1890, 3, (with a figure of *Etheostoma camurum*, by an error of printer), Tippecanoe River, Marshland, Indiana, (Type, No. 40080. Coll. Evermann); BOULENGER, Cat., I, 79.

### 1480. ETHEOSTOMA PUNCTULATUM (Agassiz).

Head 3⅓; depth 5⅔; eye large, 3⅓ in head; snout 4⅓. D. X or XI–14; A. II, 8 or 9; scales 9–63 to 80–16, 43 to 53 pores. Body slender, compressed, the ventral outline nearly straight, the back scarcely elevated; upper profile descending in a gentle regular curve from front of dorsal to snout, which is below axis of body. Snout sharp; mouth terminal, moderately oblique, large, the maxillary reaching vertical from middle of pupil, 3 in head; premaxillaries not protractile. Teeth on vomer and palatines, outer series in upper jaw enlarged. Preopercle entire; opercular spine very slender. Gill membranes not united across isthmus. Fins rather small. Pectorals and ventrals about equal, the latter not nearly reaching vent, as long as from snout to nape; dorsals not joined at base, the spines rather strong; anal with two slender subequal spines, as long as diameter of orbit, the first stronger than second; caudal truncate. Body covered with small ctenoid scales, which become very fine on the nape; breast naked; an enlarged black humeral scale; cheeks and opercles naked; lateral line straight, ending below last rays of soft dorsal, the tubes wanting on about 20 scales. Colors in life: Very dark slaty green, with indistinct darker bars, irregular in number and size, downward from back; belly and branchiostegal membranes deep orange red; sides of head coarsely punctate with black; top of head dusky, a dark bar forward from eye, one upward and backward across upper portion of cheek and opercle and a broad bar downward to behind the mandible; a conspicuous black humeral spot; usually a darker area at base of caudal, one below soft dorsal and a dusky bar in axil of pectoral, ending below the fin in a blackish blotch; spinous dorsal dusky green at base, a broad black bar through its middle, more conspicuous anteriorly, its margin reddish; second dorsal, caudal, and pectorals light reddish, with indistinct wavy bars formed of black punctulations; anal and ventrals dusted with coarse black specks. Length 2 inches. Ozark region of southwestern Missouri; not very common; in small brooks; here described from specimens from James Fork of White River, Marshfield, Missouri. (*punctulatus*, with little points.)

*Pœcilichthys punctulatus*, Agassiz, Amer. Jour. Sci. and Arts, 1854, 304, Osage River, Missouri.

*Boleosoma punctulatum*, Vaillant, Recherches, 92, 1873.

*Etheostoma punctulatum*, Gilbert, Proc. U. S. Nat. Mus., x, 1887, 60; Boulenger, Cat., i, 79.

### 1481. ETHEOSTOMA CRAGINI, Gilbert.

Head 3⅓; depth 4¾. D. VIII or IX-10 to 12 (VI, 12 in one specimen, probably abnormal); A. II, 6 or 7; scales 6–46 to 55, pores 15 to 20. Head and body heavy and not closely compressed, the back not elevated, the caudal peduncle deep; snout short and broad, less than diameter of orbit, 5 in head; mouth terminal, broad, little oblique, the lower jaw included; the maxillary scarcely reaching vertical from front of pupil, 3½ in head. Premaxillaries nonprotractile. Eye large, much longer than snout, equaling length of maxillary. Interorbital space narrow, less than diameter of pupil. Preopercle entire; opercle ending in a short, flat point, the spine poorly developed. Gill membranes very slightly connected across the isthmus. A conspicuous black humeral scale. Fins small, the pectorals reaching but little beyond tips of ventrals, 1⅓ in head; spinous dorsal low, the spines strong, the longest about ⅖ length of head; anal fin very small; first anal spine longer and stronger than the second, 3½ in head; caudal truncate, equaling length of pectorals. Scales weakly ctenoid, uniformly covering body, including nape and ventral region, becoming somewhat smaller anteriorly on sides; cheeks and opercles with few scales or none, head and breast otherwise naked. Color in spirits: Olivaceous, much mottled with dusky above; lower half of sides sprinkled with coarse black specks, and with traces of two silvery lines; middle of sides with a series of about 12 dusky spots as large as pupil, the interspaces silvery; a black spot on opercle, one behind and one below orbit; snout dusky; caudal conspicuously barred with light and dark; soft dorsal and anal faintly barred; spinous dorsal translucent, dusted with minute dark points, margined with blackish; traces of orange markings on lower side of head, and on bases of pectoral fins; caudal apparently tinged, in life, with bright yellow. In life, fins with brick-red shades; body with blue specks; body and fins profusely punctulate with black. Length 1½ inches. Western portion of Arkansas River Basin, from Garden City to Cañon City, in small brooks; the only darter reaching the base of the Rocky Mountains in Colorado. (Named for its discoverer, Prof. F. W. Cragin, then director of the Washburn College Laboratory.)

*Etheostoma cragini*, GILBERT, Bull. Washburn College Laboratory for March and April, 1885, 99, small stream connecting the "Lake" at Garden City, Kansas, with the Arkansas River, (Type, No. 38320. Coll. Cragin); GILBERT, Proc. U. S. Nat. Mus., 1887, 62; JORDAN, Bull. U. S. Fish Comm., IX, 1889 (1891), 17; BOULENGER, Cat., I, 77.

### 1482. ETHEOSTOMA OBEYENSE, Kirsch.

Head 3⅔; depth 4½ to 5½. D. VIII to X-12 or 13; A. II, 7 to 9; scales 5-45 to 50-10, pores 10 to 27. Body rather long and low, compressed, the back not much elevated in adults, more so in the young. Head moderate, heavier and less pointed than *Etheostoma flabellare*, which this species resembles in many respects. Interorbital space narrow, eye about as long as snout, 4 in head, the maxillary extending nearly to below its middle. Mouth rather large, little oblique, the jaws subequal; premaxillaries not protractile; teeth rather strong; gill membranes slightly connected. Head, nape, and breast naked. Margin of first dorsal rounded, its longest spine 2 in base; second dorsal larger than first, its margin nearly straight, the anterior ray about 1⅓ in base; caudal moderate, equal in length to caudal peduncle, also to base of first dorsal, its margin subtruncate; anal smaller than second dorsal and placed opposite or slightly behind that fin; pectorals about as long as head; ventrals equal in length to base of anal. Lateral line almost straight, beginning at upper edge of preopercle and extending backward, slightly descending, to past middle of first dorsal, developed on about 12 scales. Color of adult male, light olive; dorsal region marked with 7 dark cross bars, the first being on the nape and the last on the end of the caudal peduncle; on the sides are 10 or 11 irregularly-shaped dark spots; top of head dusky or black; fins of adult males dusky white; black spot on membrane of first 3 or 4 dorsal spines, vanishing posteriorly; second dorsal with faint traces of bars; caudal plain; margin of anal jet black; pectorals faintly barred; ventrals dusky or black. The female and younger specimens are similarly, but more deeply, colored. Black humeral scale very large and distinct, larger than in related species, as in *Etheostoma flabellare*. The anal, pectorals, and ventrals of the female and younger specimens are plain white, while the dorsals and caudal are distinctly barred; on the cheek is a smooth, light-colored area, extending from below the eye obliquely upward and backward to a distance twice the length of eye, and terminating at upper edge of preopercle, constricted into two parts, the anterior somewhat the larger, and everywhere bounded by a silvery band, being a notable color mark. Length 2¾ inches. Tributaries of the Cumberland River in Clinton County, Kentucky. (Name from Obey River.)

*Etheostoma obeyense*, KIRSCH, Bull. U. S. Fish Comm., x, 1890 (1892), 292, Indian Creek, Spring Creek, Smith Creek, and Albany Branch, all tributaries of Cumberland River in Clinton County, Kentucky (Type, No. 45565. Coll. Kirsch); BOULENGER, Cat., I, 78.

### 1483. ETHEOSTOMA PAGEI, Meek.

Head 3½; depth 4 to 4¼; eye 3½; snout 3½. D. IX or X-12 or 13; A. II, 7; scales 8-56 to 61-13. Body robust, snout abruptly decurved, but not blunt. Mouth rather large, terminal, maxillary reaching vertical from pupil; premaxillaries not protractile; lips thick; gill membranes not connected. Cheeks, opercles, and breast naked, nape scaled; lateral line imperfect, developed on only about 12 scales. Color of male: Belly bright red, extending on sides to upper rays of pectoral fins; above the red is a yellowish band on the sides about as wide as diameter of eye; upper part of the body olivaceous, with darker markings, each scale being provided with a dark spot, these making faint lateral streaks along the rows of scales; about 9 dark blotches on the side, resembling faint bars; caudal and soft dorsal barred; pectorals faintly barred; anal and ventrals plain; a dark humeral scale. The female has the under part whitish, the sides olivaceous, much mottled with darker; otherwise as in the male. Length 2 inches. Only the types known, 2 specimens, taken in the spring branch on the United States Fish Hatchery grounds at Neosho, Missouri, tributary to Neosho River, Arkansas Basin. (Meek.) (Named for William F. Page, Superintendent of the United States Fish Hatchery at Neosho, Missouri.)

*Etheostoma pagei*, Meek, American Naturalist, 1894, 957, Neosho, Missouri, (Type, No. 45566. Coll. Meek); Boulenger, Cat., i. 79; Evermann & Kendall, Bull. U. S. Fish Comm., xiv, 1894 (1895), 472.

### 1484. ETHEOSTOMA VIRGATUM (Jordan).

Head 3⅔; depth 5. D. IX–10; A. II, 8. Body slender, subfusiform, compressed, the back somewhat elevated, the caudal peduncle rather deep. Head long, rather slender and pointed, little compressed, the snout but little decurved. Mouth rather large, somewhat oblique, the maxillary reaching to the pupil, the lower jaw scarcely shorter than the upper; teeth small, even, in several rows. Eye rather large. Posterior border of preopercle obtusely crenate above. Scales rather large; lateral line distinct, on about 20 scales; 53 in a lengthwise series. Head naked; nape and breast naked. Color greenish, each scale with a small blackish spot, forming conspicuous lateral stripes, as in *Etheostoma flabellare lineolatum*; back and sides with cross blotches; humeral scale large and black; dorsal and caudal fins faintly barred. Rock Castle River and Round Stone River, tributaries of Cumberland River, in Rock Castle and Laurel counties, Kentucky; not common; a pretty little fish. (*virgatus*, streaked.)

*Pœcilichthys virgatus*, Jordan, Proc. U. S. Nat. Mus., 1879, 236, Rock Castle River, Livingston, Kentucky, (Type, No. 23456. Coll. Jordan); Jordan & Gilbert, Synopsis, 515, 1883.
*Etheostoma virgatum*, Boulenger, Cat., i, 77.

## Subgenus CLARICOLA, Jordan & Evermann.

### 1485. ETHEOSTOMA JULIÆ, Meek.

Head 4; depth 4 to 4⅕. Eye 4½. D. XI–11 or 12; A. II, 7 or 8; scales 8–58 to 60–8. Lateral line incomplete; cheek and breast naked, opercles with few scales on upper part. Ventral region scaled, like the sides. Gill membranes broadly united across the isthmus. Teeth on vomer. Body deep, compressed, with the dorsal region elevated, the form being much as in *Cottogaster uranidea.* Mouth large, terminal, the lower jaw but little the shorter; snout pointed, upper lip thick; premaxillary not protractile, the frenum narrow, torn in the type. Tip of maxillary reaching to front of pupil. Pectoral fins large, their length equal to the length of the head; ventrals small, not close together; anal small, with 2 short, sharp spines.* Color in life, dusky olivaceous, greenish below; caudal fin, soft dorsal, anal, and ventral fins yellowish; pectoral fins dusky, with outer border pale yellowish; spinous dorsal dusky, upper half with a yellowish tinge; a faint dark band on chin; a dark bar below eye; a black band across back in front of spinous dorsal, terminating at base of pectoral fins; a second and much fainter band on back between spinous and soft dorsal; a third faint band on back at middle of soft dorsal, and a fourth on caudal peduncle; sides dotted with faint yellowish, forming irregular stripes along rows of scales. On the posterior half of body are 6 faint, dark, vertical bars. One of the handsomest of the darters in life. Length 2¼ inches. Basin of White River, Missouri. Only the types known. (Named for Mrs. Julia Hughes Gilbert.)

*Etheostoma juliæ,* Meek, Bull. U. S. Fish Comm., ix, 1889 (1891), 130, plate 42, fig. 2, James River, near Springfield, Missouri, (Coll. Meek, Drew & Rettger); Boulenger, Cat., i, 87.

### 1486. ETHEOSTOMA ARTESIÆ (Hay).

Head 3⅖; depth 5. D. XI–12 or 13; A. II, 7 or 8; scales 8–46 to 56–11. Body elongate, compressed. Head large. Mouth large, terminal, nearly horizontal, the lower jaw slightly included; maxillary reaching to opposite front of pupil. Palatine teeth in a broad band. Eye equal to snout, 4½ in head. Cheeks entirely covered with small scales; opercles with large scales; scales along back very small. Lateral line extending to end of second dorsal, on about 45 scales. Dorsals contiguous; first dorsal as long as head, its height less than half its length; soft dorsal considerably higher; anal a little over half length of head; pectorals reaching tips of ventrals, much smaller than in *E. cœruleum.* Gill membranes largely connected. Yellowish olive, with transverse oblique bars of darker, and sprinkled with small blotches of carmine; pectorals and ventrals dull blue; dorsals with a broad band of carmine along their middle, bordered on each side by orange; tips of dorsals dull blue, as is the base of the soft dorsal; base of spinous dorsal with several carmine spots; anal mostly crimson, tipped with blue; caudal blue, then orange, carmine orange, and tipped with blue; a black humeral scale. Length 2⅗ inches. Georgia† to Central Texas (Palestine), in sandy streams of the pine woods; rare; perhaps intergrading through *Etheostoma alabamæ* with *E. whipplii.*

*Pœcilichthys artesiæ,* Hay, Proc. U. S. Nat. Mus., 1880, 494, small branch of the Catawba River, Artesia, Lowndes County, Mississippi. (Type, No. 27434. Coll. Hay).

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*This species is described and figured as having but 1 anal spine. In one of Dr. Meek's types in the Museum of Stanford University, two spines are well developed, as in its ally, *Etheostoma whipplii.*

†A specimen from Georgia (24524, M. C. Z.) has scales, 46. Another specimen is from an artesian well in Alabama.

### 1487. ETHEOSTOMA ALABAMÆ (Gilbert & Swain).

This species or subspecies is closely allied to *Etheostoma whipplii* differing from it in having the scales constantly larger, there being usually 50 to 56 in the course of the lateral line, though occasionally 58 and even as low as 43; the pores of the lateral line wanting on about 12 scales; the number of rows of scales between the lateral line and the spinous dorsal is 7 or 8, occasionally fewer. Gill membranes moderately united; humeral process or scale developed, black. Not otherwise differing from *Etheostoma whipplii,* the form and coloration similar. The relations of this species with *Etheostoma artesiæ* are also very close, the two may prove inseparable. The male of *artesiæ* seems to have much more of blue marking than the male of *alabamæ.* Black Warrior and Big Cahawba rivers, Alabama; locally abundant.

*Etheostoma whipplei alabamæ,* GILBERT & SWAIN, Proc. U. S. Nat. Mus., 1887, 62, Black Warrior River near Morris and Tuscaloosa, Alabama. (Coll. Gilbert & Swain.)

### 1488. ETHEOSTOMA WHIPPLII (Girard).

Head 3½; depth 4½ to 5; eye 4¼ in head. D. IX to XII–12 to 14; A. II, 7. Scales 60 to 70,* 8 or 9 series between lateral line and base of spinous dorsal; pores 35 to 50. Body rather deep, compressed; least depth of caudal peduncle equaling length of snout and eye. Mouth terminal, oblique; maxillary reaching vertical from front of pupil, 3⅓ in head. Premaxillaries not protractile. Eye moderate, slightly greater than snout. Preopercle entire; opercular spine strong. Gill membranes rather widely joined across isthmus. Fins larger than in *E. punctulatum*; dorsals slightly joined at base, the longest soft ray half length of head; pectorals somewhat longer than ventrals, which equal distance from snout to preopercular margin; first anal spine longer and much stronger than second; caudal truncate. Scales small; lateral line straight, ending under last rays of soft dorsal, the pores wanting on 16 to 20 scales; opercles with a few large ctenoid scales; breast and ventral region, cheeks, nape, and a strip along base of spinous dorsal anteriorly naked or with embedded, cycloid scales. Colors in life: Grayish, mottled with darker and with about 12 indistinct dusky bars, becoming more clearly marked posteriorly; scales of lighter interspaces on sides with small, round, bright, orange-red spots, those near lateral line in longitudinal series of 2 to 5; 2 orange blotches at base of caudal; a dark spot below eye and 2 behind it, 1 of these on upper part of cheeks, the other fainter, on occiput. A conspicuous black humeral process; spinous dorsal dusky translucent at base, a dark bar about halfway up, then a translucent bar, an orange-red bar, and a translucent bar tipped with dusky; soft dorsal similarly marked, with more yellowish; anal like soft dorsal, the orange brighter, sometimes covering distal half of fin, the basal dusky area fainter; caudal barred with light

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*In a single specimen from the Washita River at Arkadelphia, Arkansas, but 48 scales are present. No other of many examples has less than 60. It is this variation of *whipplii* which led Gilbert & Swain to regard *alabamæ* as a subspecies of it. The extent of such intergradation needs examination.

and dark and margined with black, sometimes with a submarginal band of orange. Lower Arkansas Basin; locally abundant in clear tributaries of the Saline, Washita, etc. (Named for Lieut. A. W. Whipple, U. S. A., in command of the survey by which the species was discovered.)

*Boleichthys whipplii*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 103, Coal Creek, Arkansas.

*Boleosoma whipplei*, VAILLANT, Recherches, 96, 1873.

*Etheostoma whipplei*, GILBERT, Proc. U. S. Nat. Mus., 1887, 61; BOULENGER, Cat., I, 84.

### 1489. ETHEOSTOMA SQUAMICEPS, Jordan.

Head 3⅕ to 4⅙; depth 4¼ to 5. Snout short, as long as eye, 4 in head. D. VIII to XI–9 to 12; A. II, 7 or 8; scales 6–48 to 60–12. Body rather robust, the back not elevated, the sides somewhat compressed, the caudal peduncle stout. Head rather short, the snout rather blunt, the anterior profile somewhat decurved. Premaxillary not protractile. Mouth small, oblique, the lower jaw somewhat included; the maxillary extending to front of eye, 3½ in head. Teeth rather large, close set. Preopercle entire. Gill membranes rather broadly united. Opercular spine well developed. Nape, cheek, opercles, and breast covered with small scales; these parts rarely naked; body with moderate, ctenoid scales, those on belly similar; lateral line straight, its pores wanting only on the last 4 or 5 scales. Fins all low; dorsal spines subequal, the longest about 3½ in head; soft dorsal well separated from spinous dorsal, its longest rays not quite equaling head; caudal fin rather large, 1⅖ in head; anal small, the longest rays 1⅔ in head, the spines small; pectorals 1⅕ in head; ventrals 1½. Color in life dusky olive, with about 10 rather diffuse blackish cross bands, most distinct just below lateral line, along which is a longitudinal pinkish streak; scales above with many dark punctulations, but with no distinct spots; a dark bar below eye, and a horizontal dark streak through it; both dorsals and caudal barred with black in fine pattern, as in *E. flabellare*, but less distinctly; lower fins pale; no red or blue markings anywhere. This species varies excessively in squamation of head and in size of fins; nape, breast, and cheeks sometimes naked. Lower Wabash Valley, Indiana, through western Kentucky and Tennessee to Georgia and western Florida; abundant in sandy streams southward. Specimens from Alabama (var. *parvipinnis*) are smaller, with lower fins and fewer fin rays. D. XI–10; A. II, 7; scales 6–48–13. They seem to vary perfectly into the typical form. (*squama*, scale; *-ceps*, head.)

*Etheostoma squamiceps*, JORDAN, Bull. x, U. S. Nat. Mus., 11, 1877, Russellville, Kentucky (Type, No. 1345. Coll. Dr. Bebb). (Head 3⅕; depth 5. D. IX–12; A. II, 7; scales 5–50–X); JORDAN & GILBERT, Synopsis, 51 4, 1883. (Type, No. 1345. Coll. Dr. Bebb); BOLLMAN, Proc. U. S. Nat. Mus., 1886, 464; BOULENGER, Cat., I, 85.

*Etheostoma parvipinne*, GILBERT & SWAIN, Proc. U. S. Nat. Mus., 1887, 59, small spring branch tributary to the Black Warrior River, Tuscaloosa, Alabama. (Type, No. 36716. Coll. Gilbert & Swain.)

### Subgenus ETHEOSTOMA.

### 1490. ETHESTOMA FLABELLARE, Rafinesque.

(Fan-tailed Darter.*)

Head 3⅗ to 4; depth 4½ to 5½; eye 4 to 4½ in head; snout 4. D. VIII–12 to 14; A. II, 7 to 9; scales 9–40 to 65–14, 15 to 40 pores. Number of fin rays and scales subject to large variations, the spines occasionally fewer than 8. Body slender, compressed, the back not elevated; head long and pointed; snout not decurved, the upper lip on a level with top of eye; mouth very oblique, lower jaw projecting; maxillary reaching front of eye; interorbital space narrow, 1½ in eye; gill membranes rather broadly united; distance from mouth to gill cleft on median line 1½ to 1⅓ in head; caudal peduncle compressed, deep, its least depth 2 in head. Fins all low, the first dorsal in the male about ⅓ as high as second, higher in the female, the spines with enlarged fleshy tips in the male; anal about size of soft dorsal; pectorals usually not quite as long as head, their tips reaching beyond tips of ventrals; caudal large, rounded. Scales moderate; head entirely naked; lateral line nearly straight, incomplete, reaching about to end of first dorsal; a narrow strip along base of spinous dorsal not scaled. Color rather dark, body covered with numerous fine dark specks, these forming dark cross bands or blotches in the males, less distinct in the females; black humeral spot conspicuous; usually a dark line across opercles, through the eye, and around snout; second dorsal and caudal fins barred, other fins usually plain; pectorals faintly barred in Virginia specimens. Length 2½ inches. New York to Virginia, west to Iowa, and south to South Carolina and northern Alabama; usually abundant wherever found. It lives in swift waters, and its movements in the water are more active than those of any other species; it is the most hardy in the aquarium. (*flabellaris*, like a fan, from the form of the tail.)

*Etheostoma flabellaris*, Rafinesque, Jour. de Physique, 1819, 419, tributaries of Ohio River.

*Etheostoma flabellata*, Rafinesque, Ichth. Ohiensis, 36, 1820, Ohio River.

*Etheostoma fontinalis*, Rafinesque, Ichth. Ohiensis, 86, 1820, Ohio River.

*Etheostoma linsleyi*, Storer, Proc. Bost. Soc. Nat. Hist., 1851, 37, Wolcott, Wayne County, New York.

*Oligocephalus humeralis*, Girard, Proc. Ac. Nat. Sci Phila., 1859, 67, James River, Virginia.

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*The Darter of Darters is the Fan-tail (*Etheostoma flabellare*). Hardiest, wiriest, wariest of them all, it is the one which is most expert in catching other creatures, and the one which most surely evades your clutch. You can catch a weasel asleep when you can put your finger on one of these. It is a slim, narrow, black, pirate-rigged little fish, with a long pointed head, and a projecting, prow-like lower jaw. It carries no flag, but is colored like the rocks among which it lives. It is dark brown in hue, with a dusky spot on each scale, so that the whole body seems covered with lengthwise stripes, and these are further relieved by cross bands of the same color. Its fins, especially the broad, fan-shaped caudal, are likewise much checkered with spots of black. The spines of the dorsal fin are very low, and each of these in the male ends in a little fleshy pad of a rusty-red color, the fish's only attempt at ornamentation. The Fan-tailed Darter chooses the coldest and swiftest waters, and in these, as befits his form, he leads an active, predatory life. He is the terror of water snails and caddis worms, and the larvæ of mosquitoes. In the aquarium this Darter is one of the most interesting of fishes, for, though plainly colored, it is very handsome, and in its movements is the most graceful of all the Darters. Its mouth opens wider than that of any of the others, and it is fuller of bristling teeth. Its large, yellow-rimmed black eyes are ever on the watch. The least of a "fish" and the most of a Darter, the Fan-tailed is worthily left as a type of the genus *Etheostoma*, in which it was first placed by its discoverer, Rafinesque. (*Jordan & Copeland.*)

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*Catonotus fasciatus*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 68, Madrid, New York, and Grass River. (Type, Nos. 1393 and 1345. Coll. E. O. Dayton.)
*Catonotus kennicotti*,* PUTNAM, Bull. Mus. Comp. Zool., I, 1863, 3, southern Illinois.
*Catonotus flabellatus*, VAILLANT, Recherches, 121, 1873, with plate.
*Etheostoma flabellare*, JORDAN & GILBERT, Synopsis, 513, 1883; BOULENGER, Cat., I, 86.

A slight variety of this species, from the Cumberland Mountains, has been recognized by name as

### 1490a. ETHEOSTOMA FLABELLARE CUMBERLANDICUM, Jordan & Swain.

Head $3\frac{2}{3}$; depth $5\frac{2}{3}$; eye $4\frac{1}{4}$ in head, equal to snout. D. VIII, 11; A. II, 7; scales 45, the tubes on 15 to 20 scales. Body moderately elongate, somewhat compressed, the back little elevated. Head usually thick and heavy, little tapering anteriorly, much stouter than in *E. flabellare*. Mouth terminal, very oblique, the lower jaw somewhat projecting, maxillary extending nearly to below its middle. Teeth rather strong. Head, nape, and breast naked; belly and region along dorsal with the scales small; scales of body smoother than in *E. flabellare* and more loosely imbricated, especially in the adult. Fins essentially as in other species, the dorsal spines low and subequal, lowest in the male, the flesh at their tips being thickened; caudal large, rounded; other fins moderate. Color in life greenish, semitranslucent, the body in the adult without trace of lines, cross bars, or spots, excepting the large, black humeral spot; back with a few faint dusty cross shades. Young with tessellated spots and numerous faint cross bars, which are developed chiefly as a series of spots along the lateral line; a dark streak from eye through snout; a round, black spot behind eye; first dorsal translucent, abruptly edged with black, the free tips of the spines golden orange; second dorsal obliquely barred with alternating bands of black and golden; caudal pale, with about 7 very sharply defined curved cross bands of black; pectorals olivaceous, scarcely barred, an orange bar at base; ventrals and anal plain, slightly dusky. Length $2\frac{3}{4}$ inches. Brooks in the Cumberland Mountains tributary to Cumberland River.

*Etheostoma cumberlandicum*, JORDAN & SWAIN, Proc. U. S. Nat. Mus., 1883, 251, small streams of the Cumberland Mountains, Wolf Creek and Briar Creek, near Pleasant View, Whitley County, Kentucky. (Coll. Jordan & Swain.)

A better marked variety, differing chiefly in color, representing *Etheostoma flabellare* to the northwestward, is

### 1490b. ETHEOSTOMA FLABELLARE LINEOLATUM (Agassiz).

Very similar to the typical *flabellare*, but rather less elongate and more compressed. Coloration darker, each scale with a dark spot, these forming a series of conspicuous longitudinal lines along the rows of scales;

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*The original types of *Catonotus kennicotti*, now in poor condition, show the following characters: Color plain, without trace of lines or spots on body; pectorals, caudal, and both dorsals brightly checkered with black. Black humeral spot large. Cheeks, opercles, and breast naked. Scales rather large. Lateral line extending to below middle of second dorsal. Gill membranes forming an angle with each other. Pectorals a little shorter than head. Head $3\frac{3}{4}$; depth $5\frac{1}{2}$. D. VIII, 10; A. II, 7; scales 5–40 to 42–X. From a rocky brook in Southern Illinois.

second dorsal and anal conspicuously cross-barred; head blackish, with darker stripes radiating from eye; males further marked with conspicuous dark cross bars. Minnesota to northern Indiana and northern Missouri, in cold weedy streams. (*lineolatus*, with small lines.)

*Catonotus lineolatus*, AGASSIZ, Amer. Journ. Sci. and Arts, 1854, 305, small creeks near Quincy, Illinois.
*Etheostoma lineolatum*, JORDAN & GILBERT, Synopsis, 513, 1883.
*Catonotus lineolatum*, VAILLANT, Recherches, 118, 1873.

## 476. ALVARIUS, Girard.

*Alvarius*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 101, (*lateralis*).

This genus is based on a single species, which has not been recognized since it was originally described. It is apparently closely allied to *Etheostoma*, differing in the small number of its fin rays, in which regard it approaches *Microperca*. The species is imperfectly described and its affinities can only be guessed at. (A coined name without meaning.)

### 1491. ALVARIUS LATERALIS, Girard.

"A representative of the Etheostomoid family was procured by the United States and Mexican Boundary Commission at the mouth of the Rio Grande del Norte (Rio Bravo). It constitutes a new generic pety allied to *Catonotus*, and to which we have applied the name of *Alvarius*, with the following characters: Head elongated and tapering. Mouth terminal, large, not protractile; lower jaw longer than the upper. Teeth very minute. Opercular apparatus, cheeks, and throat scaly. First dorsal nearly equal in height to the second, from which it is quite distinct. Anal fin much smaller than the second dorsal; caudal fin truncated; 5 soft rays to the ventrals. Ventral scales uniform." Body slender, elongate. Head subconical and tapering forward. Eye equal to snout, 4 in head. Maxillary reaching pupil. First dorsal about equal to second and separated from it. Anal smaller than second dorsal, the last rays of the 2 fins opposite each other. Scales very small. Lateral line median. Brownish, back spotted; sides with a narrow blackish streak, which extends around the snout; first dorsal with a black spot on its upper posterior edge; caudal transversely barred. D. VI, 10; A. 8. Length 1¾ inches. Rio Grande. (Girard.) The types are now lost and the species has not been rediscovered. (*lateralis*, pertaining to the side.)

*Alvarius lateralis*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 101, mouth of Rio Grande, (Coll. Mex. Bound. Surv.); VAILLANT, Recherches, 141, 1873.
*Pœcilichthys lateralis* JORDAN & GILBERT, Synopsis, 522, 1883.
*Etheostoma laterale*, BOULENGER, Cat., I, 87.

## 477. PSYCHROMASTER, Jordan & Evermann, new genus, (*tuscumbia*).

This genus is allied to *Etheostoma*, from which it differs in its robust form, its single anal spine, and especially in the squamation of the head, which is scaled to the snout. One species. (ψυχρός, coldwater; μαστήρ, searcher.)

#### 1492. PSYCHROMASTER TUSCUMBIA (Gilbert & Swa ).

Head 3½ to 3¾; depth 4 to 4½. D. IX or X–11 to 13; A. I, 8; scales 6–48 to 50–10; pores 15 to 20. Body exceedingly heavy and robust, with elevated back and broad, thick head. Anterior profile descending rapidly from front of dorsal, the snout blunt and broadly rounded, but not overhanging the mouth. Gape large and wide, the mandible little included, the maxillary reaching vertical from middle of orbit, 3 in head. Eye rather small, 4⅓ in head, the interorbital width ⅔ its diameter. Preopercular margin entire. Cheeks, opercles, nape, and top of head generally scaly; only the snout, interorbital space, and preorbitals naked. Opercular spine little developed. Gill membranes scarcely joined across isthmus. Fins all very small; dorsal spines weak, the median spines highest, half length of head; soft dorsal scarcely higher than spinous; anal fin with a single, rather weak spine, the first soft ray articulated and branched. Pectorals and ventrals very small, the latter not reaching ⅔ distance to vent; length of pectorals equaling distance from tip of snout to preopercular margin; caudal broadly rounded. Scales rough, wholly enveloping head and body, except snout and interorbital space; lateral line incomplete, arched, following the curve of the back; pores absent on 15 to 18 scales. Color in life: Varying shades of grayish and greenish olive, much mottled and speckled with black; six broad, dark bars across back; 8 or 10 linear black blotches along lateral line, separated by silvery interspaces; a dark streak before, one below, and one behind orbit; opercle and top of head dusky; pectorals with several dark bars, ventrals unmarked; a black blotch at base of each caudal lobe; other fins more or less barred with light and dark. Length 2 inches. Spring brooks in the Tennessee River basin in northern Alabama; locally abundant.

*Etheostoma tuscumbia*, GILBERT & SWAIN, Proc. U. S. Nat. Mus., 1887, 63, stream flowing from the great spring at Tuscumbia, Alabama, (Type, No. 36154. Coll. Gilbert & Swain); BOULENGER, Cat., I, 89.

### 478. COPELANDELLUS, Jordan & Evermann.

*Copelandellus*, JORDAN & EVERMANN, new genus, (*quiescens*).

This genus differs from *Boleichthys* in having the top of the head closely scaled. One species, found in the lowland swamps and everglades of the south. (Named for Herbert Edson Copeland, 1849–1876, who studied the Darters because he loved them, and who began a monograph of the group in 1874, a work not yet finished, although many have worked upon it.)

#### 1493. COPELANDELLUS QUIESCENS (Jordan).

Head 3⅔; depth 4⅔. D. IX to XII–9 to 12; A. II, 7; scales 3–48 to 56–10, pores on 21 to 28 scales. Body not greatly elongate, compressed, the back elevated, the back higher and the tail shorter than in *Boleichthys eos*. Maxillary extending to front of pupil; jaws equal; preopercle a little crenulate above. Eye much longer than snout, 3½ in head. Cheeks, opercles, and whole top of head closely scaled; breast and nape scaled; snout, jaws, and preorbital naked; lateral line running very high, as in *Boleichthys fusiformis*, from which this species is chiefly distinguished by the scaly crown, a character seen also in *P. tuscumbia*. Gill membranes separate, a small black humeral spot. Caudal long, 1⅓ in head, rounded or pointed behind; pectoral nearly as long as head. Color dark brown, the pale parts chiefly bright red in life; back with some dark markings; side with a broad black lateral band, mottled and interspersed with red; an area of red along lateral line; some black spots on lower part of side; a black spot at base of pectoral; 3 black bars about eye; 4 or 5 round black spots in a cross series at base of caudal, the 2 middle ones conspicuous; fins checkered; dorsal, anal, and caudal finely barred; ventrals, anal, and pectorals plain. Length 1⅖ inches. Swamps and streams of the lowlands from Virginia to Florida; known from Blackwater River, Zuñi, Virginia; Allapaha River, Nashville, Georgia, and various streams in Florida; the southernmost known species of the darters. Specimens from Orlando, Florida (Coll. Einar Lönnberg), are larger and more brightly colored than those from the Dismal Swamp region. (*quiescens*, lying quiet.)

*Pœcilichthys quiescens*, JORDAN, Proc. U. S. Nat. Mus., 1884, 478, tributary of the Allapaha River, Nashville, Georgia, (Type, No. 28509. Coll. W. J. Taylor.)

*Etheostoma quiescens*, JORDAN, Rep. U. S. Fish Comm., v, 1885, 869; WOOLMAN, Bull. U. S. Fish Comm., x, 1890 (1892), pp. 294, 297, 299, 300, and 302, pl. 53, fig. 3; BOULENGER, Cat., I, 75.

## 479. BOLEICHTHYS, Girard.

*Boleichthys*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 103, (*exilis*).

This genus contains small and slender species allied to those of the section *Oligocephalus* under *Etheostoma*. The lateral line is incomplete and has a slight upward curve anteriorly instead of being straight as in all the species of *Etheostoma*. Top of head not scaly. Lowland streams and swamps; the species few, variable, and hard to determine. (*βολίς*, dart; *ἰχθύς*, fish.)

*a.* Cheeks and opercles scaly. FUSIFORMIS, 1494.
*aa.* Cheeks naked; opercles more or less scaly. EXILIS, 1495.

### 1494. BOLEICHTHYS FUSIFORMIS (Girard).

Head 3½ to 4; depth 3¾ to 6; eye about 4 in head. D. IX or X–9 to 12; A. II, 6 to 8; scales 3–43 to 60–12, pores 10 to 30. Body usually elongate, compressed; head rather long and narrow; muzzle short, decurved, shorter than eye; mouth comparatively large, terminal, lower jaw slightly included, maxillary reaching to pupil; premaxillaries not protractile; gill membranes somewhat connected. Opercular spine strong. Caudal peduncle long. Scales strongly ctenoid; cheeks scaled; opercles, nape, and breast usually well scaled, sometimes partly naked, especially the breast; lateral line incomplete, high up, often interrupted. Fins moderate; pectorals broad, about reaching tips of ventrals. Olivaceous, sides and back dotted and blotched with dusky, paler beneath; head dark above, with dusky dots on sides, a dark line downward and another forward from the eye; base of caudal with 4 dark spots in a vertical row. Dorsal and caudal fins speckled and barred with dark; the spinous dorsal in life usually bright blue, with a median crimson band. An extremely variable species found in lowland streams and ponds from Massachusetts to the Rio Grande and west to Minnesota. Throughout this entire region small darters are found, which agree more or less closely with typical *fusiformis*, from Charles River, Massachusetts, but presenting slight variations for different regions. To these have been given the various specific names found in the accompanying synonymy.* (*fusiformis*, spindle shaped.)

*Boleosoma fusiformis*, Girard, Proc. Bost. Soc. Nat. Hist., 1854, 41, **Charles River, Massachusetts.** (Coll. Girard.)

*Boleosoma barratti*, Holbrook, Journ. Ac. Nat. Sci. Phila., 1855, 56, **South Carolina.**

*Boleosoma gracile*, Girard, Proc. Ac. Nat. Sci. Phila., 1859, 103, **Rio Seco and Leona River, near Fort Inge, Texas.** (Type, No. 1328. Coll. Kennerly.)

*Hololepis erochrous*, Cope, Proc. Ac. Nat. Sci. Phila., 1864, 233, **Brown's Mill, New Jersey, opposite Philadelphia,** (Coll. Cope); Vaillant, Recherches sur Etheost., 133, 1873, with plate.

*Boleichthys eos*, Jordan & Copeland, Proc. Ac. Nat. Sci. Phila., 1877, 46, **Rock River, Wisconsin; Wisconsin River, Wisconsin,** (Coll. Jordan & Copeland); **Fox River, Illinois,** (Coll. Jordan); **Northern Indiana,** (Coll. Dr. G. M. Levette); perhaps a valid species.

*Pœcilichthys butlerianus*, Hay, Bull. U. S. Fish Comm., II, 1882 (1883), 61, **shallow pool on Big Black River near Vaughans Station, Yazoo County, Mississippi,** (Coll. Hay); Jordan & Gilbert, Synopsis, 519, 1883.

*Pœcilichthys palustris*, Gilbert, Proc. U. S. Nat. Mus. 1884, 209, **Switz City Swamp, Greene County, Indiana.** (Coll. Gilbert.)

*Hololepis barratti*, Vaillant, Recherches sur Etheost., 127, 1873, with plate.

*Hololepis fusiformis*, Vaillant, Recherches sur Etheost., 131, 1873, with plate.

*Pœcilichthys barratti*, Jordan & Gilbert, Synopsis, 519, 1883.

*Pœcilichthys fusiformis*, Jordan & Gilbert, Synopsis, 520, 1883.

*Pœcilichthys erochrous*, Jordan & Gilbert, Synopsis, 520, 1883.

*Pœcilichthys eos*, Jordan & Gilbert, Synopsis, 521, 1883.

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*Some of the results of a comparison of specimens of this species from different localities may be given here:

*a*. Thayer Lake, Michigan (*eos*). These specimens are a little stouter and darker in color; the scales on the cheeks obscure, in this respect approaching *exile*; scales 55.

*b*. Northern Illinois (*eos*). Stouter, the depth 5 in length; scales 56, 4 rows above lateral line; scales on cheeks evident; 3 spots at base of caudal.

*c*. Southern Illinois (*barratti*). Still stouter, depth 4½; scales 49, 3 rows above lateral line; cheeks well scaled; color nearly plain; sides with faint bars, and a single spot at base of caudal.

*d*. Terre Haute, Indiana (*palustris*). Depth 5; scales 50, 3 rows above lateral line; snout rather short; cheeks well scaled; a single faint caudal spot; markings obscure; bluish bars in life.

*e*. Trinity River, Dallas, Texas (*gracilis*). Similar to *b* in color and form, a little stouter; cheeks well scaled; scales 50, 3 rows above lateral line; 3 spots at base of caudal.

*f*. Saline River, Benton, Arkansas (*gracilis*). Similar to *e*. Scales 49; 3 spots at base of caudal.

*g*. Sims Bayou, Houston, Texas (*gracilis*). Snout blunter; color much paler; spots at base of caudal scarcely perceptible; scales 53.

*h*. Mount Vernon, Indiana (*palustris*). Stout; depth 4⅓; scales; 53, 1 row above lateral line; 1 caudal spot; snout bluntish; no dark lateral stripe.

Possibly these several varieties may be separated by the following characters:

- *a*. Body very slender, depth about 6 in length.
  - *b*. a dark lateral stripe and more or less of red markings; 4 dark spots at base of caudal. FUSIFORMIS.
  - *bb*. Paler, no evident dark lateral stripe, but body finely spotted or mottled with dark; no red spots; 3 faint spots or none at base of caudal. GRACILIS.
- *aa*. Body stoutish, depth 4½ to 5½ in length; no dark lateral stripe.
  - *c*. Snout moderate; scales on cheeks small; sides with crimson spots. EOS.
  - *cc*. Snout bluntish; no bright red; sides with greenish cross shades. PALUSTRIS.
  - *ccc*. Snout rather sharp; body nearly plain greenish. BARRATTI.

*Pœcilichthys gracilis*, Jordan & Gilbert, Synopsis, 521, 1883.

*Etheostoma fusiforme*, Evermann & Kendall, Bull. U. S. Fish Comm., xii, 1892 (1894), 115; Boulenger, Cat., i, 75; and of authors generally.

### 1495. BOLEICHTHYS EXILIS, Girard.

Head 3¾; depth nearly 6. D. IX or X–10 or 11; A. II, 7 to 9. Body compressed, tapering toward the caudal peduncle, which is slightly contracted. Maxillary reaching anterior edge of pupil. Lateral line nearer dorsal than the abdominal outline; pectorals extending beyond ventrals. Cheeks naked, yellowish brown, speckled with grayish black; dorsals and caudal barred; a dark spot on occipital region, and a streak in advance of as well as below the orbit. (Girard.) Length 1 to 2 inches. This species differs from *Boleichthys fusiformis* in the naked cheeks.* It is probably a variety of the latter. Upper Missouri River Basin and Red River of the North (spec. Mus. Comp. Zoöl.). (*exilis*, slim.)

*Boleichthys exilis*, Girard, Proc. Ac. Nat. Sci. Phila., 1859, 103, Little Muddy River, a tributary of the Upper Missouri. Type a little stouter than *B. fusiformis*, the head heavier; scales 53; pores 22.

*Boleichthys warreni*, Girard, Proc. Ac. Nat. Sci, Phila., 1859, 104, Cannon Ball River.

*Pœcilichthys exilis*, Jordan & Gilbert, Synopsis, 521, 1883.

*Pœcitichthys warreni*, Jordan & Gilbert, Synopsis, 521, 1883.

*Etheostoma exile*, Bollman, Bull. U. S. Fish Comm., viii, 1888, 224; Boulenger, Cat., i, 76.

## 480. MICROPERCA, Putnam.

*Microperca*, Putnam, Bull. i, Mus. Comp. Zoöl., 4, 1863, (*punctulata*).

This genus differs from *Etheostoma* in the almost or quite complete absence of the lateral line. The scales are larger than in most of the other darters, the fin rays and vertebræ fewer. Gill membranes considerably connected; mouth small, the lower jaw included. The species of *Microperca* are the smallest in size of the darters, and are plainly colored. They are very closely allied and may all be varieties of *Microperca punctulata*. (*μικρός*, small; *πέρκη*, perch.)

| | |
|---|---|
| *a.* Cheeks and opercles scaly; anal spines 2; scales 36. | PRŒLIARIS, 1496. |
| *aa.* Cheeks and opercles chiefly naked. | |
| *b.* Anal spines 2. | PUNCTULATA, 1497. |
| *bb.* Anal spine single. | FONTICOLA, 1498. |

### 1496. MICROPERCA PRŒLIARIS, Hay.

Head 4; depth 4⅕. D. VIII–11; A. II, 6; scales 36. Body short and stout. Snout conical, pointed; jaws equal; mouth small, slightly oblique, maxillary reaching front of eye. Eye small, 4 in head. Cheeks and opercles with large scales. Opercular spine well developed. Scales large, the tubes of the lateral line developed on 2 to 4 of them; dorsals well

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*Specimens of a small darter obtained by Mr. Charles H. Bollman in Clam Lake, Michigan, may belong to this species. These specimens, however, differ materially in the number of dorsal rays. Dorsal VII–10; A. II, 7; lateral line extending to end of anal; scale 55; tubes interrupted, 37 to 40; cheeks naked.—*Bollman, Bull. U. S. Fish Comm., vii, 1888 (1890), 124.*

separated. Anal spines slender, high; pectorals and ventrals reaching about to vent. Olive, speckled with brown; 10 brownish spots along the sides; black streaks downward and forward from eye; dorsal fins mottled. Length 1½ inches. Alabama and Mississippi, west to Arkansas, in lowland streams and ponds. (*prœliaris*, pertaining to battle, it being found on the battlefield of Corinth.)

*Microperca prœliaris*, Hay, Proc. U. S. Nat. Mus., 1880, 496, small branch of the Tuscumbia River, at Corinth, Mississippi, (Type, No. 27418. Coll. Hay); Hay, Bull. U. S. Fish Comm., ii, 1882 (1883), 62; Jordan & Gilbert, Synopsis, 522, 1883.

*Etheostoma prœliaris*, Gilbert, Bull. U. S. Fish Comm., ix, 1889 (1891), 159.

*Etheostoma prœliare*, Boulenger, Cat., i, 89.

### 1497. MICROPERCA PUNCTULATA, Putnam.

### (Least Darter.)

Head 3¾ to 4; depth 4½ to 5. D. VI to VIII–9 or 10; A. II, 6; scales 34 to 37–9. Body rather short and deep, somewhat compressed, the back arched. Caudal peduncle rather long. Head moderate; snout somewhat decurved; mouth moderate, terminal, oblique, the maxillary extending to below eye; jaws equal. Cheeks naked; opercles with a few scales; opercular spine very small; neck and chest naked; no trace of lateral line; the usual series of tubes along the temporal region; scales quite large, strongly ctenoid. Vertical fins short; anal spines strong, the first usually the largest; ventrals rather long. Coloration olivaceous, the sides closely speckled and with vague bars and zigzag markings; second dorsal and caudal barred; dark streaks radiating from eye; a dark humeral spot. Length 1 to 1½ inches. Smallest of the darters and one of the smallest of fishes; common in the clear, cold, weedy streams and ponds of the Northwestern States from Indiana, Michigan, and Minnesota, south to Arkansas, where it may intergrade with *fonticola*, as Dr. Meek has specimens with 1 and 2 anal spines; rare outside of tributaries of the Great Lakes. (*punctulatus*, speckled.)

*Microperca punctulata*, Putnam, Bull. i, Mus. Comp. Zoöl., 4, 1863, from various points in Michigan, Wisconsin, Illinois, and Alabama [those from Alabama probably *M. prœliaris*] (name preoccupied in *Etheostoma* by *E. punctulatum*, Agassiz); Jordan & Gilbert, Synopsis, 523, 1883.

*Etheostoma microperca*, Jordan & Gilbert, in Jordan's Manual of Vertebrates, Ed. 5, 134, 1888, substitute for *punctulata*, preoccupied in *Etheostoma*; specimens from lakes of Laporte County, Indiana; Boulenger, Cat., i, 87.

### 1498. MICROPERCA FONTICOLA (Jordan & Gilbert).

Head 3⅗ to 4; depth 4½ to 5. D. VI or VII–8 to 10; A. I, 7; scales 34. This species or variety is very close to the northern *Microperca punctulata*. The only tangible differences seem to lie in the coloration and in the constant presence in *Microperca fonticola* of but one anal spine. The head in *Microperca fonticola* is nearly or quite devoid of scales. In life, light olivaceous, the scales broadly margined behind with dusky; about 8 indistinct dusky cross blotches on back, the dorsal region dusted with fine dusky specks; a series of dark, stitch-like, short horizontal lines along the middle of the sides, forming an interrupted lateral streak; three small dark spots at base of tail; soft parts of vertical fins with light and dark bars; lower half of spinous dorsal jet black, then a broad red band narrowly edged above with black; a dusky streak below orbit and one in front of it. Arkansas and Texas, in clear rocky streams; rather scarce; known only from Washita River, at Arkadelphia; San Marcos River, at San Marcos, Texas; Comal Creek, at New Braunfels, Texas. (*fons*, fountain; *colo*, to inhabit, it being most common in the great spring in which the Rio San Marcos rises.)

*Alvarius fonticola*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1886, 23, San Marcos River, San Marcos, Texas. (Type, No. 36523. Coll. Jordan & Gilbert.)

*Etheostoma fonticola*, EVERMANN & KENDALL, Bull. U. S. Fish Comm., XII, 1892 (1894), 115, pl. XXXVI, fig. 4; BOULENGER, Cat., I, 90.

## Family CXLIV. CHEILODIPTERIDÆ.

### (THE CARDINAL FISHES.)

Body oblong or elongate, sometimes compressed and elevated, covered with rather large scales, which are striated and ctenoid, or sometimes cycloid; cheeks scaly; lateral line continuous; cleft of mouth wide, oblique; villiform teeth on jaws and vomer, and sometimes on palatines; canines sometimes present; (teeth wanting in *Brephostoma*); preopercle with a double ridge, its edge entire or slightly serrated; opercular spine little developed; lower pharyngeals separate, with sharp teeth; pseudobranchiæ present; branchiostegals 6 or 7. Dorsal fins well separated, the first with 6 to 9 rather strong spines; no dorsal sheath or furrow; anal fin short, usually with 2 spines, sometimes with 3 or 4; ventral fins thoracic, I, 5, without axillary scale. Small fishes of the tropics, especially abundant in the East Indies, some of them in fresh waters, most of them in rather deep waters. Color often bright red. Genera about 15; species about 130. (*Percidæ*, part; group *Apogonina*, Günther, Cat., I, 222–250, 1859.)

CHEILODIPTERINÆ:

*a.* Body oblong, not greatly compressed nor greatly elongate; anal spines 2, rarely 3; teeth present in jaws at least.<br>
*b.* Anal fin with 2 spines, the soft rays usually 8 or 9.<br>
*c.* Canines none; teeth all villiform; lateral line normal.<br>
*d.* Palatines with teeth.<br>
*e.* Scales large, 20 to 30 in lateral line.<br>
*f.* Preopercle with its posterior edge distinctly serrate, at least in the young. APOGON, 481.<br>
*ff.* Preopercle with its ridges entire at all ages. APOGONICHTHYS, 482.<br>
*ee.* Scales small, 40 to 45 in lateral line. GLOSSAMIA, 483.<br>
*dd.* Palatines toothless; teeth moderate; eye very large; body elongate; scales rather small; preopercle entire or nearly so. EPIGONUS, 484.<br>
*cc.* Canines present in jaws. Dorsal spines 6; opercle unarmed; anal spines 2. CHEILODIPTERUS, 485.<br>
*bb.* Anal fin with 3 spines and 8 soft rays; no teeth on vomer or palatines; no canines; caudal rounded; opercles entire; body moderately elongate. AMIICHTHYS, 486.

SCOMBROPINÆ.

*aa.* Body elongate, the form approaching that of the Barracuda (*Sphyræna*); mouth large; anal spines 3 or 4.
  *g.* Teeth subequal, without distinct canines; preopercle serrate. D. VII–I, 10; A. III, 7; scales small, about 60. SPHYRÆNOPS, 487.
  *gg.* Teeth unequal, the jaws with long canines; preopercle entire or nearly so.
    *h.* Second dorsal and anal long, each of 12 to 14 soft rays; soft parts of vertical fins scaly; scales rather small, 45 to 50. SCOMBROPS, 488.
    *hh.* Second dorsal and anal short, each with 7 to 9 soft rays; vertical fins scarcely scaly; scales large, about 30. HYPOCLYDONIA, 489

## 481. APOGON,[*] Lacépède.

### (KINGS OF THE MULLETS.)

*Amia*, GRONOW, Zoophyl., 80, 1763, (*moluccensis*; nonbinomial); GILL, Proc. Ac. Nat. Sci. Phila., 1862, 237, (*imberbis*; scales 20 to 28).
*Apogon*, LACÉPÈDE, Hist. Nat. Poiss., III, 411, 1802, (*ruber* = *imberbis*).
*Ostorhinchus*, LACÉPÈDE, Hist. Nat. Poiss., IV, 165, 1802, (*fleurieu*).
*Dipterodon*, [†]LACÉPÈDE, Hist. Nat. Poiss., IV, 167, 1802, (*hexacanthus*, etc.).
*Monoprion*, POEY, Memorias, II, 123, 1860, (*maculatus*).
?*Lepidamia*, GILL, Proc. Ac. Nat. Sci. Phila., 1863, 81, (*kalosoma*; scales 33 to 38).
*Mionurus*, KREFFT, Proc. Zoöl. Soc. Lond., 1867, 942, (*lunatus*).

Body oblong, compressed, covered with large, ctenoid scales. Lateral line continuous, with 20 to 30 scales. Head large; mouth wide, oblique, the maxillary extending to below middle of the large eye; villiform teeth on jaws, vomer, and palatines; no canine teeth; preopercle with a double ridge, the edge somewhat serrate, at least in the young, becoming entire with age in some species; opercle with a spine behind. Gill rakers rather long. Dorsal spines 6 or 7, strong; second dorsal remote, short; anal with 2 spines and 8 or 9 soft rays,[‡] the second much the longer, the soft part similar to the soft dorsal; pectorals and ventrals moderate; vertebræ 11 + 14 = 25. Warm seas; the species numerous. (ά, without; πόγων, a beard; thus distinguished from the bearded mullet, *Mullus barbatus.*)

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[*] The following description of the skull of *Apogon* is given by Dr. Günther: The skull of the species of the genus *Apogon* is distinguished by the hemispherical prominent capsula cerebri, formed by the parietal and occipital bones and by the hinder part of the frontals; the latter past is generally provided with 2 or more small spinous prominences; the orbital part of the frontals is very developed, not flat, but with a deep, narrow groove along the median line; this groove is bifid behind, thus separating the orbital part of the frontals from the posterior. In front of the median groove is a high ridge, generally half as long as the diameter of the eye, and bifid behind; this ridge, together with those spinous prominences of the frontals, is for the purpose of keeping the skin suspended above the grooves. Large mucose cavities are formed thereby, communicating with those of the suborbital arch, etc. The occipital crest is very developed and broad, more or less truncated behind, reaching downward to the vertebral column and supported by another, narrower, horizontal one, which arises also from the occipital. Another peculiarity of the skull of *Apogon* is the internal free ridge of the preoperculum, parallel to the external margin. The operculum is always supported by a strong, straight bony ridge, conspicuous from the outside, but prominent only at the inner surface; it arises near the articulation of the operculum with the epitympanic (*os temporale*), and projects sometimes in a small free spine at the hinder angle of the operculum. In *Apogon imberbis* the lower outer margin only of the preoperculum is very finely denticulated, the teeth becoming smaller at the angle. The vomerine and palatine teeth are arranged in a single row, the series of the former forming a right angle. There are 11 abdominal and 14 caudal vertebræ.

[†] This genus, as defined by Lacépède, includes species of *Lutianus*, *Apogon*, *Aspro*, *Bairdiella*, etc. As one of these species, *hexacanthus*, is type of the earlier genus *Apogon*, *Dipterodon* may be regarded as a synonym of *Apogon*.

[‡] 12 to 17 soft rays in the East Indian genus *Archamia*.

*a.* Base of caudal with a distinct round blackish blotch (rarely wanting).
  *b.* Base of soft dorsal without blackish saddle-like blotch.
    *c.* Opercle without dark spot; cheeks without evident dark dots; soft dorsal much higher than spinous; scales 28 to 30. IMBERBIS, 1499.
    *cc.* Opercle with a dark spot; cheeks dusted with dark points; soft dorsal half higher than spinous; scales 25. DOVII, 1500.
  *bb.* Base of soft dorsal with a distinct blackish saddle-like blotch extending downward on sides of body; scales 25. RETROSELLA, 1501.
*aa.* Base of caudal without blackish blotch.
  *d.* Soft dorsal with a round black blotch below it and a similar one on caudal peduncle above; scales 26. MACULATUS, 1502.
  *dd.* Soft dorsal and caudal peduncle without round black spots.
    *e.* Body with few black specks or none; a blackish bar between last rays of soft dorsal and anal; another on caudal peduncle. BINOTATUS, 1503.
    *ee.* Body covered everywhere with blackish dots, like fly specks; no other distinct markings; scales 25. PIGMENTARIUS, 1504.

### 1499. APOGON IMBERBIS (Linnæus).

(KING OF THE MULLETS; ALFONCINO; FUNCINITA.)

Head 3⅓; depth 3⅕. D. VI–I, 9; A. II, 8; scales 28 to 30; vertebræ 10 + 15. Body ovate, moderately compressed; eye large; preopercle finely serrate. Bright scarlet, with minute black specks; fins red, a black blotch at base of caudal on each side, this sometimes wanting; dark shades made of fine dots, usually present on each angle of caudal, tips of second dorsal and anal, and between the eyes. Mediterranean and neighboring waters; once taken at Newport, Rhode Island,* and once recorded from the island of Fernando de Noronha. (*imberbis*, without beard, a character which distinguishes *Apogon* from *Mullus*.)

*Mullus imberbis*, LINNÆUS, Syst. Nat., Ed. x, 1758, 300, Malta; after ARTEDI.

*Apogon ruber*, LACÉPÈDE, Hist. Nat. Poiss., III, 411, 1802, Malta.

*Ostorhinchus fleurieu*, LACÉPÈDE, Hist. Nat. Poiss., IV, 165, 1802, Equinoctial Ocean.

? *Dipterodon hexacanthus*, LACÉPÈDE, Hist. Nat. Poiss., IV, 167, 1802, Equinoctial Ocean.

? *Centropomus auratus*, LACÉPÈDE, Hist. Nat. Poiss., IV, 273, 1802, Equinoctial Ocean; this species, and the two preceding, based on notes and drawings of Commerson, representing some species of *Apogon* with a black bar at base of caudal.

*Centropomus rubens*, SPINOLA, Ann. Mus. Hist. Nat., x, 1806, 370, plate 28, fig. 2, Mediterranean.

*Perca pusilla*, DE LA ROCHE, Ann. Mus. Hist. Nat., XIII, 1809, 318, Nice.

*Dipterodon ruber*, RAFINESQUE, Caratteri, 47, 1810, Palermo.

*Apogon rex-mullorum*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., II, 143, 1828, Marseilles; Nice; Genoa; Iviça; Naples; Palermo.

*Apogonichthys americanus*, COPE, Proc. Ac. Nat. Sci. Phila., 1870, 120, Newport, Rhode Island; not of CASTELNAU.†

*Apogon imberbis*, GÜNTHER, Cat., I, 230, 1859.

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* Wrongly identified by Cope as *Apogon americanus* (Castelnau), a Brazilian species, not known to occur north of Bahia.

† The following description of the true *Apogon americanus* (Castelnau) is taken from a specimen from Bahia: Head equal to depth of body, 2⅘ in length, maxillary 1⅔ in head, eye 2⅓. D. VI–I, 8; A. II, 8, scales 2–25–9. Gill rakers slender and long, about 8 + 10 in number. Preopercle very finely serrate above, mostly entire below, except near the angle, when its surface is irregularly notched. Color red, unmarked, except for a diffuse dusky blotch made up of dark points on the opercle, and some dark spots on snout and cheeks. No spot at base of caudal, and no spot or marking anywhere on body or fins, except the dusty blotch on head.

### 1500. APOGON DOVII, Günther.

Head 2½; depth 3; eye large, less than 3 in head. D. VI–I, 9; A. II, 8; scales 3–25–9. Palatine and vomerine teeth present; upper jaw slightly overlapping the lower; maxillary extending backward to below the posterior third of the orbit. Operculum with an upper flexible point, and with a lower stiff spine. The third dorsal spine a little longer than the second, ½ the length of the head, ⅔ height of longest ray of second dorsal. Caudal fin slightly emarginate, with the angles rounded. Only the hind margin of the posterior preopercular ridge is serrated. A roundish black spot on each side of the root of the caudal; the spinous dorsal colorless, transparent; uniform olive (in spirits); head densely punctulated with brown. Length 2½ inches. Mazatlan to Panama; generally common southward. Very close to *Apogon imberbis*. (Named for Capt. John M. Dow, its discoverer.)

*Apogon dovii*, GÜNTHER, Proc. Zoöl. Soc. Lond., 1861, 371, Panama. (Coll. Dow.)

### 1501. APOGON RETROSELLA (Gill).

(CARDENAL.)

Head 2¾; depth 2⅞ to 3⅕; scales 2½–26–9. Dorsal VI–I, 10; anal II, 7; eye 2⅞ to 3¼ in head; maxillary 1¾; snout 3¾ to 4½; interorbital space 4; height of first dorsal 1⅞; of second dorsal 1⅖; caudal 1⅕ in head; pectoral 1¾; ventral 1¾. Body rather plump, not much compressed, the profile rising steeply from snout to first dorsal. Caudal peduncle long and strong; eye very large; mouth large, oblique, the maxillary opposite posterior margin of pupil. Teeth small, the outer scarcely enlarged. Premaxillary protractile; no supplemental maxillary. Preopercle minutely serrulate on its vertical margin only, these serrulations soft and easily rubbed off in the adult, distinct in the halfgrown. Bright scarlet, much dotted with black; cheek with many dark points; a diffuse dark blotch on opercle; a diffuse black blotch at base of caudal; first dorsal with triangular red area in front of base; second dorsal red at base, the anterior half jet black above the red, the posterior half translucent; from black anterior rays a rather faint black saddle falls to middle of side; caudal red at base, upper and lower lobes black, the middle pale; anal red at base, the anterior rays black, the posterior pale; pectoral white, the base deep scarlet; ventral white, red at base, blackish at tip; opercle reddish within, with some dusky. Young more sharply colored, with less black on fins, the spots on body more distinct. Color of half-grown examples scarlet, deeper below and on tail, fading on fins; second dorsal, anal, and caudal tipped with blackish; an oblong inky spot at middle of base of caudal; an inky bar below soft dorsal extending to level of pectoral and spreading on base of soft dorsal; a black bar from snout through eye to gill opening, broader and clearer behind, overlaid by reddish, a fainter dusky band below parallel with it. Length 4 inches. Pacific Coast of Mexico; about rocks; known from Cape San Lucas, and from the Venados and Isla Blanca, near Mazatlan; rather rare; a singularly pretty little fish; our specimens obtained by the use of dynamite. (*retro*, behind; *sella*, saddle.)

*Amia retrosella*, Gill, Proc. Ac. Nat. Sci. Phila., 1862, 251, Cape San Lucas. (Coll. Xantus.)
*Apogon retrosella*, Jordan, Fishes of Sinaloa, in Proc. Cal. Ac. Sci., 1895, 442, plate 37.

### 1502. APOGON MACULATUS (Poey).

Head 2¾; depth 2⅘. D. VI–I, 9; A. II, 8; scales about 2½–26–7. Maxillary 1⅘ in head, reaching beyond pupil; eye very large, 3 in head; preopercle distinctly serrulate. Pectoral 1⅔ in head, somewhat shorter than caudal. Color intense scarlet, nearly uniform; a tinge of crimson about pectorals and on sides of head; a round, black, ink-like spot, a little larger than pupil, under second dorsal; another, smaller, on upper part of tail, on each side, just before root of caudal; tip of caudal whitish; tip of anal dusky; iris red. Length 2½ inches. West Indian fauna, from Pensacola to Bahia, in rather deep water; common on the "Snapper Banks;" often found in the stomachs of snappers and groupers; a very handsome little fish. (*maculatus*, spotted).

*Monoprion maculatus*, Poey, Memorias, ii, 123, 1860, Cuba.
*Apogon maculatus*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 279.
*Apogon maculata*, Jordan & Gilbert, Synopsis, 930, 1883.

### 1503. APOGON BINOTATUS (Poey).

Like *Apogon pigmentarius* in all respects except that it lacks the black dots of pigment. Mouth, eyes, and scales similar. Caudal lunate. Rosy; a black vertical band uniting last rays of second dorsal with the anal, and another on the caudal peduncle. (Poey.) Cuba. Not seen by us. (*binotatus*, two-spotted.)

*Amia binotata*, Poey, Repertorio, 234, 1867, Cuba.

### 1504. APOGON PIGMENTARIUS (Poey).

Head with flap, 2½; depth 3; eye 3¼; snout very short, 4¼; D. VI–I, 8; A. II, 8; scales 3–25–3. Body considerably compressed, especially on caudal peduncle whose least depth equals length of head from snout to posterior border of orbit. Mouth large, oblique, the maxillary reaching slightly beyond posterior rim of orbit. Preopercle serrate. Longest dorsal spine 2½ in head or 1½ in height of soft dorsal. Scales ciliated. Caudal forked. Carmine red with purple reflections on the head; profusely and irregularly covered with small black dots like fly specks, most distinct on jaws and cheeks; fins all pale. Length 2 inches. Cuba; common at Havana, where our specimens were obtained. (*pigmentarius*, having dots or points.)

*Monoprion pigmentarius*, Poey, Memorias, ii, 123, 1860, Cuba.

## 482. APOGONICHTHYS, Bleeker.

*Apogonichthys*, Bleeker, Floris, 321, 1854, (*perdix*).

This genus differs from *Apogon* only in having the preopercle entire at all ages; scales very large (20 to 26) and cycloid. Small species, similar in habit to those of *Apogon*, found in the tropical seas. The genus is scarcely distinct from *Apogon*. (*Apogon*; ἰχθύς, fish.)

*a.* Scales in lateral line 21 to 23; body with many dark points.
  *b.* Ventrals short, not reaching vent; dorsal rays VI–I, 9. ALUTUS, 1505.
  *bb.* Ventrals long, extending beyond anal; dorsal rays VII–I, 9. STELLATUS, 1506.
*aa.* Scales in lateral line 30; ventrals long, reaching beyond front of anal; body everywhere with black specks; dorsal VI–I, 9. PUNCTICULATUS, 1507.

### 1505. APOGONICHTHYS ALUTUS (Jordan & Gilbert).

Head 2¾; depth 2¾. D. VI–I, 9; A. II, 8; scales 21. Head much compressed, short and high, its height at occiput 6/7 its length; snout short and blunt, less than interorbital width, about half diameter of orbit; mouth very oblique, the maxillary reaching beyond pupil, but not to posterior margin of orbit; length of maxillary 1¾ in head; teeth in narrow villiform bands in each jaw, those on vomer and palatines minute; eye of moderate size, 2⅘ in head; orbital rim elevated above and behind; interorbital width 3⅓ in head, with a low median longitudinal ridge; both ridges of preopercle entire; opercle without spine; gill rakers slender, the longest rather more than half diameter of orbit, 8 or 9 on anterior branch of outer arch. First dorsal low, of 6 rather weak spines, its base ⅖ length of head, and equal to greatest height of fin; second dorsal high, the longest ray 1½ in head. Anal similar to second dorsal; second anal spine half length of longest ray, which is contained 1¾ in head; caudal 1⅓; ventrals not reaching vent, 1⅔, and pectorals 1¾, in length of head. Color rusty red with silvery luster; sides of head little reddish. Body and fins everywhere much soiled and freckled with dark points. First dorsal blackish, thickly punctate; second dorsal, anal, and caudal yellow, smutty with dark points, the posterior half of the caudal more dusky. Ventrals smutty yellow; pectorals colorless. Snapper Banks off Pensacola and Tampa; not rare; the known specimens from stomachs of the Red Snapper, *Neomænis aya*. (ἄλουτος, unwashed.)

*Apogon alutus*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 279, and in Synopsis, 931, 1883, Snapper Banks, Pensacola. (Coll. Jordan & Stearns.)

### 1506. APOGONICHTHYS STELLATUS, Cope.

D. VII–I, 9; A. II, 8; P. 10; scales 7–23. Ventral with elongate rays extending beyond last anal ray. Caudal rounded. End of maxillary reaching nearly to opposite posterior margin of large orbit. A delicate frontal carina. Greatest depth 3 times to base of caudal. End of muzzle truncate, with emargination to receive tubercle of mandible. Reddish brown, with a series of dark brown spots on the edges of the scales of each row (except that bearing the lateral line), each with a silver center;

head with numerous silver-centered brown spots. Caudal, dorsal, and anal fins dark, with dusky cross bars. Total length 1 inch, 7.5 lines; head 7.5 lines. Bahamas; one specimen known. (Cope.) (*stellatus*, with starry spots.)

*Apogonichthys stellatus*, Cope, Trans. Amer. Philos. Soc., 1866, 400, Nassau, Bahama Islands.

### 1507. APOGONICHTHYS PUNCTICULATUS, Poey.

Head 3¾ in total; depth 3¾. D. VI-I, 9; A. II, 8; scales 3–30–8; eye 2½, twice length of snout. Preopercle with both margins entire; mouth oblique, the maxillary reaching to posterior margin of pupil; teeth in villiform bands; ventral reaching beyond pectoral to middle of anal fin. Scales cycloid. Reddish with blue reflections on the opercle; head and middle of trunk covered with black specks, as are also the fins, except the pectoral, which is blackish at the tip. Cuba. (Poey.) Not seen by us. (*puncticulatus*, with fine specks.)

*Apogonichthys puncticulatus*, Poey, Repertorio, II, 233, 1867, Cuba.

## 483. GLOSSAMIA, Gill.

*Glossamia*, Gill, Proc. Ac. Nat. Sci. Phila., 1863, 82, (*aprion*).

This genus contains a few species with small, cycloid scales, 40 to 45 in the lateral line, and the preopercle entire. The anal is short, as in *Apogon* and *Apogonichthys*, its rays being about II, 9. (γλῶσσα, tongue; *Amia* = *Apogon*.)

### 1508. GLOSSAMIA PANDIONIS (Goode & Bean).

Head 4; depth 4. D. VII–I, 9; A. II, 8; scales small, cycloid, 3–45–9. Body oblong, rather robust, not elevated nor greatly compressed. Eye very large, forming nearly half the length of the side of the head, much greater than the interorbital space; maxillary as long as eye, extending to opposite front of pupil; preopercle entire. Gill rakers very long and slender. Mouth oblique, but not nearly vertical, the lower jaw projecting. Teeth in jaws very feeble; feeble teeth on vomer and palatines. Fins low; caudal well forked. Color nearly plain reddish, the body and fins everywhere speckled with fine dots. Deep water, off Chesapeake Bay; rare. (*Pandion*, the Osprey, named for the United States Fish Commission steamer, *Fish Hawk*, by which the species was dredged.)

*Apogon pandionis*, Goode & Bean, Proc. U. S. Nat. Mus., 1881, 160, deep water, off Chesapeake Bay. (Type, No. 26228.)

## 484. EPIGONUS,* Rafinesque.

*Epigonus*, Rafinesque, Indice Ittiol. Sicil., 64, 1810, (*macropthalmus* = *telescopium*).
*Pomatomus*, Cuvier & Valenciennes, Hist. Nat. Poiss., II, 171, 1828, (*telescopium*, not of Lacépède).
*Telescops*, Bleeker, Archiv. Néerl., XI, 261, 1876, (*telescopium*).
*Pomatomichthys*, Giglioli, Elenco Pesci Italia, 1880, 80, (*constanciæ* = *telescopium*).

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*The name *Pomatomus* can not be used for this genus. *Pomatomus* was originally framed by Lacépède for the bluefish, his "*Pomatomus skib.*" Later, in 1810, Risso described the type of *Epigonus*, referring it to *Pomatomus* as a second species of that genus. Cuvier arbitrarily renamed the bluefish *Temnodon* and retained *Pomatomus* for the type of *Epigonus*, a form unknown to Lacépède. In defiance of rules of nomenclature, most European writers have followed Cuvier in this arrangement.

Body elongate, thick, covered with rather large deciduous scales. Head very large, entirely covered with scales; eyes very large; teeth all villiform, without canines; no teeth on vomer or palatines. Branchiostegals 7; opercular bones not serrated nor spinous, the opercle ending in 2 feeble points; preopercle with prominent rounded or striated angle. Dorsals 2, well separated, the first with 7 spines; anal spines 2. Caudal forked. Soft fins more or less scaly; pyloric cœca numerous. Deep sea fishes of the Atlantic and Mediterranean.[†] *′ἐπί,* above; *γωνία,* angle, the back angulated.)

### 1509. EPIGONUS OCCIDENTALIS, Goode & Bean.

Head 3; depth 7. D. VII–9; A. II, 9; scales 4–55–8. Least height of tail equal to width of interorbital space. Eye nearly half length of head and 7 in body. Snout about ½ eye; maxillary reaching somewhat beyond anterior margin of orbit, its length half that of head without snout; premaxillary short and thin, its length about equal to that of snout, its connection with the tip of maxillary ligamentous; groove for premaxillary process naked, narrow, its length twice its width; a weak spine on the operculum. Sixteen gill rakers below the angle, the longest about ⅓ length of maxillary. Weak villiform teeth in very narrow bands on the jaws; vomer and palatines toothless. Third spine of dorsal longest. Interspace between dorsals as long as the last spine. Base of soft dorsal ⅓ as long as head, the longest ray slightly longer than base of fin. Ventral fin ⅓ length of head. Color in spirits: Upper parts dark brown; lower parts light brown; inside of mouth pale; trace of a dark band beginning on the snout and continued behind the eye, along the lateral line to the tail. Only one specimen known, secured by the steamer *Blake* off Barbadoes, in 237 fathoms. The species is very readily distinguished from the Mediterranean species (*E. telescopium*) by its more slender form and its large number of rows of scales. Length 5½ inches. (Goode & Bean.) (*occidentalis*, western.)

*Epigonus occidentalis*, GOODE & BEAN, Oceanic Ichthyology, 233, 1895, off Barbadoes. (Coll. Blake.)

## 485. CHEILODIPTERUS, Lacépède.

*Cheilodipterus*, LACÉPÈDE, Hist. Nat. Poiss., III, 539, 1802, (*saltatrix*, *macrodon*, etc., restricted by CUVIER & VALENCIENNES, in 1828, to *macrodon*).

*Chilodipterus*, GÜNTHER, amended spelling.

*Paramia*, BLEEKER, Revision Apogonini, 74, 1874, (*macrodon*, the name *Cheilodipterus* being transferred to *Pomatomus saltatrix*).

Body oblong, covered with rather large, deciduous scales; teeth on jaws, vomer, and palatines, some of them in both jaws strong, canine-like; operculum without spine; preopercle with a double margin, the posterior edge serrated; eye large. Dorsal fins separated, the first of 6 spines; anal spines 2; caudal forked. Tropical seas. (*χεῖλος*, lip; *δίς*, two, *πτερόν*, fin; fishes with 2 dorsals and the upper lip extensible.)

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[†] "Its chief characteristics are its globular eyes of extraordinary dimensions, its large and strong fins, the powers of rapid swimming, and a generally vigorous and active constitution. All these characteristics are necessary for its defense against the oceanic animals which frequent the marine abysses, where it customarily lives."—*Risso.*

### 1510. CHEILODIPTERUS AFFINIS, Poey.

Depth 4⅔ in total length with caudal. D. VI–I, 9. A. II, 9. Eye 3 in head; mouth oblique, deeply cleft, the maxillary emarginate behind, reaching to opposite center of pupil. Opercle with 2 flat spines and a stria, which ends in the lower spine, behind which the subopercular lobe extends; preopercle dentate, with a double border, having at its angle scarcely discernible points. A spine on the mastoid region; jaws with villiform teeth, with some canines in front; lower jaw with lateral canines, also. Second dorsal opposite anal; second ray of first and third of second double height of the last; ventral spine strong; caudal emarginate. Scales of back cycloid, those of sides finely ciliate; cheeks with scales. Color red; peritoneum silvery; base of caudal blackish; opercle smooth and shining. Cuba; 3 specimens known. (Poey.) Not seen by us. (*affinis*, related, to *Cheilodipterus macrodon*.)

*Cheilodipterus affinis*, Poey, Ann. Ac. Nat. Sci. N. Y., XI, 1876, 58, Havana. (Type, No. 37416.)

## 486. AMIICHTHYS, Poey.

*Amiichthys*, Poey MS., in Jordan, Proc. U. S. Nat. Mus., 1886, 586, (*diapterus*).

Body rather elongate, covered with small, caducous scales. Head bluntish, the mouth almost vertical, the lower jaw short. Small sharp teeth on jaws, none on vomer or palatines; opercles entire. Dorsal deeply notched, very long, of 13 spines and 22 soft rays; anal short, with 3 spines and 8 soft rays. Lateral line parallel with the back; caudal rounded. One species; the affinities of the genus doubtful, but probably belonging to the *Cheilodipterinæ*. (*Amia*, a name used by Gronow and Poey for *Apogon*; *ἰχθύς*, fish.)

### 1511. AMIICHTHYS DIAPTERUS (Poey).

Head 4 in total length with caudal; depth 5; eye large, 2¾ in head. D. XII–I, 22; A. III, 8; V. I, 5. Head bluntish. Mouth almost vertical; maxillary reaching pupil; lower jaw short. Teeth in jaws only, sharp, curved, and well separated. Opercles entire. Dorsals deeply notched; the third dorsal spine highest, more than half depth of body, the last spine 2 in eye; second dorsal low, its height half that of longest dorsal spine; caudal rounded; pectoral acute. Lateral line parallel with the back. Scales small, caducous, each one with a central dot. Color uniform, the eyes silvery, the vertical fins yellowish. Two specimens, 2½ inches long, from the coast of Cuba. (Poey.) Not seen by us. (*διά*, divided; *πτερόν*, fin.)

"Genus ? ——— *diapterus**," Poey, Synopsis, 305, 1861, Cuba.
*Amiichthys diapterus*, Jordan, Proc. U. S. Nat. Mus., 1886, 586.

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* In view of the doubt attached to the relations of these young fishes, the specific name only was published by Poey. With his permission, the generic name chosen by Poey was later printed by Dr. Jordan, the confusion being less if the species has some recognized name.

## 487. SPHYRÆNOPS, Gill.

*Sphyrænops*, GILL, in POEY, Memorias, II, 349, 1861, (*bairdianus*).

Body elongate, slender, covered with small scales. Head elongate; snout rather convex; preopercle rounded, its edge serrate; opercle with 3 spines, the middle one largest; eye large; mouth large. Villiform teeth on jaws and vomer. Dorsal fins well separated, the first with 7 spines; second dorsal and anal short, the latter with 3 spines; caudal forked. One species known. (*Sphyræna*, the Barracuda; ὤψ, appearance.)

### 1512. SPHYRÆNOPS BAIRDIANUS, Poey.

Head 3; depth 5⅕; eye large, as long as snout, 3 in head. B. 6; D. VII–I, 10; A. III, 7; scales about 60. Head depressed above the eye; mouth very protractile; teeth pointed, subequal. Maxillary long and pointed, reaching posterior border of pupil. Opercular spine strong; dorsals about equal in height, the longest spine 2¼ in head; ventrals longer than pectorals, which are 2¼ in head; caudal forked; anal spines weak. Carmine red; a large blue-black spot on the opercle; fins red. Known from a single young specimen taken in deep water off Cuba. (Poey.) Not seen by us. (Named for Professor Spencer Fullerton Baird.)

*Sphyrænops bairdianus*, POEY, Memorias, II, 350, 1861, Cuba.

## 488. SCOMBROPS, Temminck & Schlegel.

*Scombrops*, TEMMINCK & SCHLEGEL, Fauna Japonica, 118, 1842, (*cheilodipteroides*).
*Latebrus*, POEY, Memorias, II, 168, 1860, (*oculatus*).

Body elongate, covered with small, thin, smooth scales; lower jaw longest; 2 to 4 long canines in upper jaw, a series of canines in lower; teeth on palatines; bones of head not serrated; opercle with 2 feeble points. Eye large. Branchiostegals 7. Dorsals separated, the first of 8 very feeble spines; anal spines 3; soft dorsal and anal rather long, of 12 to 14 rays. Pyloric cœca 6 to 15. (*Scomber*, mackerel; ὤψ, appearance.)

### Subgenus LATEBRUS,* Poey.

### 1513. SCOMBROPS OCULATUS (Poey).

(ESCOLAR CHINO.)

Head 3⅙; depth 3½; eye very large, 3¼ to 3½ in head. D. VIII–I, 14; A. III, 12; scales 45 to 50. Body elongate, the dorsal and ventral outlines similar; mouth very large, the lower jaw projecting; maxillary extending beyond pupil, its length 1¼ in eye. Teeth long, sharp, slender, well separated, with conical points,† some of them enlarged, forming small canines; 12 canines on premaxillary, 2 to 4 on inner edge longer than the others; teeth on vomer and palatines compressed, in a single row; preopercle entire; opercle with 2 flat points. Dorsals well separated, the spines slender, the longest about half head. Soft dorsal and anal similar, concave in outline, the longest ray half head. Caudal forked; pectorals and ventrals short, the former 1⅘ in head; ventrals inserted under the pectorals. Scales large, caducous, with entire edges; head scaly except the lips; soft dorsal, anal, and caudal scaly. Air bladder slender; pyloric cœca 6. Violet brown, paler below. (Poey.) Coast of Cuba in deep water; reaches a weight of 14 pounds, the general appearance suggesting that of the Barracuda. (*oculatus*, big-eyed.)

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* *Latebrus*, "étymologie fantastique." (Poey.)

† In Poey's figure the premaxillary canines are represented as distinctly barbed, although nothing is said of this character in his description. If this character exists, it may define the subgenus or genus *Latebrus*, as the teeth in the Japanese *Scombrops chilodipteroides* are not barbed.

*Latebrus oculatus*, POEY, Memorias, II, 168, with plate, 1860, Cuba.
*Scombrops oculatus*, GOODE & BEAN, Oceanic Ichthyology, 236, 1895.

## 489. HYPOCLYDONIA, Goode & Bean.

*Hypoclydonia*, GOODE & BEAN, Oceanic Ichthyology, 236, 1895, (*bella*).

Body covered with thin, deciduous, cycloid scales. Entire head scaly, with the exception of the angle of the preoperculum, but the scales of the head are deeply embedded in the skin and are covered by minute pores, so that their outlines are almost entirely concealed. Eye large. Mouth moderately large; the upper jaw slightly protractile. Teeth in the premaxillary minute, in broad bands, which are separated at the symphysis; mandible with a marked concavity in front on each side of the symphysis, this concavity being armed with a band of minute teeth; 4 small canine-like teeth in an irregular group at the symphysis; 5 additional canines on the mandible, increasing in size backward and continued behind by a short, narrow band of minute teeth; minute teeth on the vomer in a triangular patch; palatine teeth in bands, which are broadest in front. Anterior nostril small, circular, not tubular; posterior nostril in a long, wedge-shaped slit. Maxillary dilated posteriorly. Lower lip well developed, broadly attached to the under surface of the maxilla. Preoperculum minutely serrated behind and below; operculum with 2 thin, flat spines. Branchiostegals 7; gill rakers in moderate number, rather stout; a glandular organ in the upper angle of the gill opening; fins well developed, the spinous dorsal longer than the second dorsal; dorsal with 9, anal with 2, spines; ventrals long; scales large, thin, cycloid, deciduous; lateral line high up, with a gradual curve nearly following outline of back. This genus resembles *Scombrops* in form and is closely related to it, but none of the vertical fins is scaly, the tongue is toothless, and the soft dorsal and anal have few rays. (*ὑπό*, below; *κλύδων*, wave).

### 1514. HYPOCLYDONIA BELLA, Goode & Bean.

Head 3; depth 3⅔; eye 3½ in head. D. IX–I, 9; A. IV, 7; scales 2–29–7. Snout ⅔ as long as eye. Maxillary reaching nearly to below middle of eye, its length ⅖ of head. Spinous dorsal inserted over origin of pectoral; the third and longest spine as long as the postorbital part of the head; interspace between the 2 dorsals very short; longest ray of soft dorsal ⅔ length of mandible. Anal spines slender. Pectoral as long as head without the snout. Ventral slightly in advance of origin of pectoral, the fin nearly as long as pectoral, its length 4 in body. Length 90 millimeters. Colors faded in the types; traces of purplish brown on the upper parts and the head; spinous dorsal with a dark triangular blotch on its upper portion, extending from the second to the sixth spine, involving less than half the height of the membrane. Specimens were obtained by the *Albatross* from station 2314, at a depth of 159 fathoms; from station 2397, at a depth of 280 fathoms; from station 2401, at a depth of 142 fathoms; from station 2417, at a depth of 95 fathoms; from station 2418, at a depth of 90 fathoms; from station 2425, at a depth of 119 fathoms, and from station 2426, in 93 fathoms. (Goode & Bean.) (*bellus*, beautiful.)

*Hypoclydonia bella*, GOODE & BEAN, Oceanic Ichthyology, 236, 1895, Gulf Stream. (Type, No. 44621.)

## Family CXLV. CENTROPOMIDÆ.

### (THE ROBALOS.)

This family is thus defined by Professor Gill (Proc. U. S. Nat. Mus., 1882, 484): "Typical *Acanthopterygians* with the postorbital portion of the skull longer than the oculo-rostral; the parietals behind the constriction continuous with the epiotics and transverse laminæ arising from the supraoccipital crest, the three together forming a well differentiated posterior oblong pentagonal or hastiform area; the reentering parietal sinus, with its anterior margin, produced forward nearest the opisthotics; the exoccipitals well developed and contiguous above the foramen magnum; the vertebræ in typical number (10 + 14) and longish; the anterior 2 partly coossified and the first with selliform apophyses extending backward and embracing the second vertebra; the vertebræ mostly with foveæ or pits for the ribs and only with developed parapophyses for the posterior (6 to 10) pairs of ribs; the second neural spine suberect, and with laminiform extensions, which embrace the first; the neurapophyses and neural spines of the other vertebræ depressed at their bases, continuous with the zygapophyses in front, and slightly curved upward at their tips; the hæmal spines resembling the neural." Subocular laminæ produced behind in a pointed process. External characters are the elongate body, with elevated back, straight abdomen and angulated base of anal. Scales ctenoid, varying in size, lateral line conspicuous, extending on the caudal fin, the tube straight, confined to basal half of the scale. Head depressed, pike-like, the lower jaw projecting; villiform teeth in bands, on jaws, vomer, and palatines; tongue smooth. Maxillary broad, truncate behind, with a strong supplemental bone. Pseudobranchiæ present, small. Preopercle with a double ridge, the posterior margin strongly serrated, with larger spines at the angle; preorbital and suprascapula serrated; opercle without true spines. Gill rakers long. Dorsal fins well separated, the first with 8 spines, the first and second short, the third and fourth longest; anal with 3 spines, the second strong, the third long and slender, these fins moving in scaly sheaths. Caudal forked. Ventrals large, I, 5, inserted well behind the pectorals, a scaly process at their base; pectorals narrow and rather pointed, the upper rays longer than lower. Branchiostegals 7. Air bladder well developed, simple or with appendages anteriorly. Species about 15, all American and referred to one genus. They are game fishes, excellent as food, the habits and character of flesh resembling the bass, as the common name Robálo * indicates. (Günther, Cat., I, 80, genus *Centropomus*.†)

## 490. CENTROPOMUS, Lacépède.

### (ROBALOS.)

*Centropomus*, LACÉPÈDE, Hist. Nat. Poiss., IV, 248, 1802, (*lucioperca*, *undecimalis*, etc., restricted to *undecimalis* by CUVIER & VALENCIENNES).

*Oxylabrax*, BLEEKER, Arch. Neerl. Sc. Ex. Nat., XI, 264, 1876, (*undecimalis*; the name *Centropomus* being restricted to *lucioperca*, the first species mentioned under the generic name *Centropomus* by Lacépède).

*Macrocephalus* (BROWNE) BLEEKER, *op. cit.*, XI, 336, 1876, (*undecimalis*).

Characters of genus included above. (*κέντρον*, spine; *πῶμα*, opercle.)

*a.* Preorbital entire or very faintly serrated; spines of fins moderate, none more than half head; lateral line black, with about 70 scales (pores); caudal fin short; air bladder usually with recurved appendages at its anterior end; anal with 6 soft rays, the last cleft to the base. Size large.

*b.* Appendages to air bladder developed; ventral fins yellow in life, the posterior part without dark blotch.

*c.* Appendages to air bladder very long, 2 to 3 times diameter of eye; third anal spine projecting beyond second. VIRIDIS, 1515.

*cc.* Appendages to air bladder short, shorter than eye; second anal spine projecting beyond third. UNDECIMALIS, 1516.

*bb.* Appendages to air bladder obsolete; second anal spine usually shorter than third, less than half depth of body; ventrals more or less blackish. NIGRESCENS, 1517.

*aa.* Preorbital with well-developed retrorse teeth, especially posteriorly; air bladder without appendages; spines longer. Size comparatively small.

*d.* Lateral line in a narrow black streak.

*e.* Scales moderate or large, 50 to 60 in lateral line; second anal spine very strong; ventrals more or less dusky; usually broadly tipped with black; anal rays III, 7, the second spine a little shorter than third.

*f.* Scales in lateral line 57 to 60; second anal spine very long, 1¼ to 1⅜ in head; depth of body 3⅔ in length. PEDIMACULA, 1518.

*ff.* Scales in lateral line 51 or 52; second anal spine 1⅔ in head.

*g.* Body rather stout, the depth about 3½ in length. GRANDOCULATUS, 1519.

*gg.* Body more slender, the depth 3¾ in length. CUVIERI, 1520.

*ee.* Scales small, about 70 in lateral line; ventrals pale; second anal spine strong, equal to depth of body; anal rays III, 6. MEXICANUS, 1521.

*dd.* Lateral line pale, not in a dark stripe; ventral fins yellowish, without black tip.

*h.* Scales very small, about 87; sides of body parallel with each other; second anal spine longer than third, equal to depth of body; anal rays III, 6. PARALLELUS, 1522.

*hh.* Scales small, 65; second anal spine very long, about equal to depth of body; third anal spine same length; angle of preopercle with about 6 long, comb-like teeth; anal rays III, 7. PECTINATUS, 1523.

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* Robálo is the Spanish name of the European bass, *Dicentrarchus* (or *Morone*) *labrax*.

† Dr. Boulenger adds to this group the old world genera, *Lates* and *Psammoperca*. These genera are apparently allied to *Centropomus*, but in them there are 11 or 12 precaudal vertebræ, 25 in all, the dorsals are connected, and there are numerous minor differences.

*hhh.* Scales large, 49 to 53 in lateral line; eye moderate, about 6 in head; anal rays III, 6.
  *i.* Second anal spine moderate, about ⅔ depth of body, little longer than third; preopercle with 2 strong teeth; back steeply elevated. UNIONENSIS, 1524.
  *ii.* Second anal spine extremely long, its length little, if any, less than depth of body; much longer than third anal spine.
    *j.* Body moderately elongate, the depth 3¼ to 3⅔ in length.
      *k.* Scales before the dorsal small, 16 to 18 in number; maxillary reaching past front of pupil. Third dorsal spine half head; scales 51. ARMATUS, 1525.
      *kk.* Scales before dorsal not crowded, 10 to 14 in number; maxillary barely reaching front of pupil; third dorsal spine not quite half head; scales 51.
        *l.* Third dorsal spine less than half head; scales 47 to 50. ROBALITO, 1526; AFFINIS, 1527.
    *jj.* Body more elongate, the depth 4 in length; second anal spine excessively long, 1⅔ times depth of body; scales 53. ENSIFERUS, 1528.

### 1515. CENTROPOMUS VIRIDIS, Lockington.

(ROBALO.)

Head 3; depth 4⅓; eye 7½ in head. D. VIII–I, 10; A. III, 6; scales 9–75–15, pores 71. Snout 3½ in head, including subopercular flap; 18 scales before dorsal; gill rakers 4 + 9. Preorbital faintly serrate, becoming entire with age. Subopercular flap extending to within 4 to 6 scales of front of dorsal. Maxillary 2⅗ in head, extending to below middle of eye. Preopercle strongly serrate, with coarser teeth at the angle. Body robust, the sides not flattened. Dorsal spines moderate, the third longest, 2 to 2½ in head; second anal spine not reaching tip of third, its length 2⅔ in head, quite variable, proportionately longest in the young. Ventral 2 in head, reaching more than halfway to anal; caudal shortish, 1½ in head; pectoral 2⅙ in head. Air bladder large, with 2 recurved appendages anteriorly, each 2 or 3 times diameter of eye. Back greenish, sides dull silvery, the upper fins dusky, the lower paler; ventrals plain yellowish, scarcely dotted with dusky; no yellow on other fins; lateral line black; some dusky at base of pectoral and behind second anal spine. Length 2 to 4 feet. Pacific Coast of Mexico; very common from the Gulf of California to Panama; a valuable food-fish, in all respects similar to *Centropomus undecimalis*. The only differences we find are the larger size of the appendages to the air bladder and the greater length of the third dorsal spine. Here described from a specimen from Mazatlan. (*viridis*, green.)

*Centropomus viridis*, LOCKINGTON, Proc. Cal. Ac. Sci., VII, 1876 (1877), 110, off Asuncion Island, Lower California. (Coll. W. J. FISHER.)

### 1516. CENTROPOMUS UNDECIMALIS (Bloch).

(ROBALO; SNOOK; BROCHET DE MER.)

Head 2⅔ to 3; depth 4 to 4¼; eye 7½ in head. D. VIII–I, 10; A. III, 6; scales 9–75 to 80–15 to 17, pores 60 to 70; snout 3½; gill rakers 4 + 9; 18 scales before dorsal. Body robust, the sides little compressed, the back not much elevated. Preorbital faintly serrated; subopercular flap extending to within 4 to 6 scales of origin of dorsal. Maxillary extending to below middle of orbit, 2⅗ in head. Dorsal spines of moderate strength, the third longest, about half as long as head; second anal spine more or less longer than third, 2 to 2⅓ in head, the spines variable in length, longer in the young. Ventrals 2 in head; pectoral 2⅙ in head; caudal shortish, 1½ in head, reaching more than halfway to anal. Air bladder with a pair of shortish appendages anteriorly, these about as long as eye. Color olive green, the sides dull silvery; dorsal fins blackish; lateral line black; ventrals pale yellowish, rarely dotted with black; blackish shades behind second dorsal spine. Length 2 to 4 feet. The largest, most abundant, and much the most important species of the genus. Common on sandy shores throughout the West Indies, from the coast of Texas to Surinam or beyond. An excellent food-fish with delicate white flaky flesh, like that of the striped bass (*Roccus lineatus*). Here described from specimens from Havana. (*undecim*, eleven, the soft dorsal with eleven rays.)

*Sciæna undecimalis*, Bloch, Ichthyol., VI, 60, pl. 303, 1792, Jamaica.

*Centropomus undecimradiatus*, Lacépède, Hist. Nat. Poiss., IV, 268, 1802, after Bloch.

*Perca loubina*, Lacépède, Hist. Nat. Poiss., IV, 397, 1802, Cayenne.

*Sphyræna aureoviridis*, Lacépède, Hist. Nat. Poiss., V, 324, 1803, Martinique.

*Centropomus appendiculatus*, Poey, Memorias, II, 119, 1860, Havana and Cienfuegos.

*Centropomus undecimalis*, Cuvier & Valenciennes, Hist. Nat. Poiss., II, 102, 1828; Vaillant & Bocourt, Miss. Sci. Mex., IV, 17, 1875; Günther, Cat., I, 79; Jordan & Gilbert, Synopsis, 528; Boulenger, Cat., I, 367.

### 1517. CENTROPOMUS NIGRESCENS, Günther.

(Robalo Prieto.)

Head 2⅘ to 2⅚; depth 4 to 4½; eye 7 to 9 in head. D. VIII–I, 10; A. III, 6; scales 10-73 to 78–19, pores 70. Gill rakers 4 + 9. Body robust, the flanks not compressed. Preorbital very faintly serrated; subopercular flap reaching to within 5 scales of origin of dorsal fin. Maxillary extending a little beyond middle of orbit, 2⅗ in head. Dorsal spines not very strong, much as in *Centropomus undecimalis*, third and fourth equal in length, 2½ to 2¾ in head; second anal spine rather shorter than third, barely ⅓ head; ventral 2⅓ in head, reaching scarcely more than ½ distance of its base from anal. Pectoral 2⅓ in head. Caudal shortish. Air bladder without appendages anteriorly. Dusky olive, sides silvery; dusky shades on opercle and base of pectoral; ventrals largely black; upper fins dusky; lateral line black. Length 2 to 3 feet. Pacific Coast of Tropical America; generally common from Mazatlan to Panama; a food fish of some importance, rather smaller in size than *Centropomus viridis*. Here described from a specimen from Mazatlan. (*nigrescens*, blackish.)

*Centropomus nigrescens*, Günther, Fishes Central America, 407, 1869, Chiapas; Vaillant & Bocourt, Miss. Sci. Mex., 20, 1875.

### 1518. CENTROPOMUS PEDIMACULA, Poey.

(Constantino de las Aletas Prietas; Robalito de las Aletas Prietas.)

Head $2\frac{4}{7}$: depth 3⅔ to 3¾; eye 5 in head. D. VIII–I, 10; A. III, 7; scales 8–55 to 58–11, pores 55: 21 scales before dorsal; gill rakers 5 + 13. Body deep, compressed, with flattened parallel sides Preorbital sharply serrate; preopercle very sharply serrate, the teeth at the angle longer; 4 spinules on the humeral plate; subopercular flap ending 6 scales before dorsal fin. Maxillary nearly reaching front of pupil, 2⅔ in head. Dorsal spines strong, the second a little shorter than third, the third 1⅔ in head; second anal spine very long and straight, 1¼ to 1⅓ in head (in Pacific Coast specimens, var. *medius*, Günther, this spine is somewhat curved, a little shorter so far as known, than in Atlantic specimens, var. *pedimacula*, 1½ to 1⅔ in head); caudal fin deeply forked, the lobes pointed, 1⅕ in head; ventral 1⅔ in head, reaching more than halfway to anal; pectoral shortish, 2½ in head. Air bladder simple. Lateral line black. Dark olive, the sides bright silvery; ventral pale yellow, tipped with black; some yellow on anal, with black behind the spines; upper fins dusky; pectoral colorless, a little dusky at its base. Length 15 inches. Both coasts of tropical America; very common in Cuba, Jamaica, and south to Brazil, and also on the west coast from Mazatlan to Panama; a food-fish of some importance. Except that the second anal spine is a little shorter and more curved in Pacific examples (*Centropomus medius*, Günther), we find no difference between these and the typical *pedimacula*. On both coasts the species enters the rivers. Here described from specimens from Havana and Mazatlan. (*pes*, foot; *macula*, spot.)

*Centropomus pedimacula*, Poey, Memorias, II, 122, 1860, Havana and Cienfuegos; Vaillant & Bocourt, Miss. Sci. Mex., 29, 1875; Boulenger, Cat., I, 371.

*Centropomus medius*, Günther, Trans. Zoöl. Soc. Lond., 1864, 144, Chiapam. (Coll. Osbert Salvin.)

### 1519. CENTROPOMUS GRANDOCULATUS, Jenkins & Evermann.

Head 2⅚; depth 3⅖ to 3⅔. D. VII-I, 10; A. III, 7; scales 8-52 to 54-13, 23 to 26 before dorsal. Body moderately elongate, somewhat compressed, but not flat-sided, the back elevated, the belly straight; nape convex; snout projecting, the profile behind it concave; maxillary 2⅔ in head, reaching front of pupil; snout 3⅕ to 3¼ * in head. Lower jaw strongly projecting; eye 5⅓ in head; preorbital with rather small retrorse serræ posteriorly; preopercle with sharp, distinct teeth on posterior limb, 2 to 4 enlarged teeth at the angle; moderate teeth below; suprascapula with 5 spines; opercular flap ending about 6 scales before dorsal, the scales before dorsal being much reduced in size. Scales of body large. Dorsal spine strong, the third much longest and strongest, 1⅚ in head, fourth slenderer and shorter; second anal spine very strong, straight, 1¾ in head. shorter than the very slender third spine; caudal well forked, 1⅕ to 1⅓ in head; pectoral 1⅞; ventral 1⅔. Color pale greenish, silvery below, the lateral line black and conspicuous, becoming straight under last dorsal spine; upper fins slightly dusky; ventrals pale or with a few dusky specks near tip; a little dusky behind second anal spine. Pacific Coast of Mexico Here described from two specimens, 1534 (L. S. Jr. Univ. Mus.), 15 inches long, and 201 (L. S. Jr. Univ. Mus.) 14 inches long, both taken by Dr. Gilbert

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* Not 3.7, as stated in the original description.

(*Albatross* Exp.) in San Juan Lagoon, on the west coast of Mexico. The larger specimen is much deeper in body than the other, and both differ somewhat from the two specimens from Guaymas, the original types. This species is very close to *Centropomus pedimacula*, but its scales are larger in all the four known specimens than in any of the latter we have seen. (*grandis*, great; *oculus*, eye.)

*Centropomus grandoculatus*,* JENKINS & EVERMANN, Proc. U. S. Nat. Mus., 1888, 139, Guaymas. (Type, No. 39630. Coll. Jenkins & Evermann.)

### 1520. CENTROPOMUS CUVIERI, Bocourt.

Head 3; depth 3¾; eye 5. D. VIII–I, 10; A. III, 7; scales 9–51–14. Maxillary reaching first third of eye; preopercle with 2 short spines at the angle, with smaller ones above and below. Third dorsal spine high, about half head; second anal spine long, but shorter than third, not quite equal to greatest depth of body. Air bladder simple. Olivaceous; sides silvery; lateral line black; ventrals dusky at tip. Length 8 inches. Haiti. (Vaillant & Bocourt.) Not seen by us. Apparently very close to *Centropomus pedimacula*, but the scales apparently larger. Dr. Boulenger refers the species to the synonymy of *Centropomus pedimacula*. (Named for Georges Leopold Dagobert Cuvier.)

*Centropomus cuvieri*, BOCOURT, Ann. Sc. Nat. Paris, 1868, 91, Haiti; VAILLANT & BOCOURT, Miss. Sci. Mex., 26, 1875, with plate.

### 1521. CENTROPOMUS MEXICANUS,† Bocourt.

Head 2¾; depth 4; eye 4. D. VIII–I, 10; A. III, 6; scales 11–69–16. Flanks compressed, parallel with each other; ventral outline nearly straight, with an angle at the anal. Suborbital with 5 or 6 sharp teeth; preopercle with 2 teeth, larger than the others; opercular lobe reaching front of dorsal. Dorsal spines high, the third longest, $1\frac{3}{7}$ in depth of body; second anal spine very long, much longer than third, equal to depth of body, 1⅗ in head. Air bladder simple. Color olivaceous, whitish below, lateral line blackish; ventrals not black. Length 7 inches. Coasts of Mexico; recorded from the Coast of the Gulf of Mexico; also reported from the State of Oaxaca; the exact locality not known. (Vaillant & Bocourt.) Not seen by us. Recorded by Steindachner from Bahia.

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* The following is a description of the Guaymas types, slightly condensed from the original: Head 2¾; depth 3⅖. D. VII–I, 10; A. III, 7; scales 8–52–10, 21 in front of the dorsal. Allied to *Centropomus pedimacula*; the body compressed, the belly straight, the back somewhat elevated; profile concave; nuchal region convex; maxillary reaching a vertical line through the pupil, 3 in head; snout 3¼ to 3⅕ in head; eye large, 5 in head; preorbital with small serræ on the posterior portion, directed backward; preopercle with nearly equal, distinct teeth on the vertical limb; a series of graduated teeth on the horizontal limb; a strong spine at the angle, and a strong spine next above the angle, sometimes bifid; 2 flat spines at the angle of the anterior ridge; suprascapula with 4 strong spines; opercular flap about reaching the vertical from the front of the dorsal. Gill rakers 6 + 16, the longest as long as pupil. Dorsal spines strong, the third being the highest and strongest, 1⅘ in head; the fourth but little shorter, but more slender, their tips, when depressed, scarcely reaching tips of ventrals; insertion of first dorsal spine midway between tip of snout and last ray of second dorsal; fourth dorsal spine 2 in head; second anal spine very strong, straight in one specimen, slightly curved in another, 1⅔ in head; third anal spine a little longer, but much more slender than the second anal and longer than the third dorsal; caudal well forked; pectoral small, 2⅕ in head, much smaller than the ventrals; ventrals with a strong spine; the spine nearly as long as the pectoral fin; soft rays of ventral as long as third dorsal spine. Scales large on the sides; crowded in front of the dorsal. Color white below; dusky above the lateral line, which is black and conspicuous; scales on back and sides covered with numerous punctulations; first dorsal somewhat dusky, second lighter, coloration of both due to fine punctulations; a large black blotch on the tips of the ventrals and anal; membrane between second and third anal spines black.—*Jenkins & Evermann.*

† Dr. Boulenger refers this species to the synonymy of *Centropomus parallelus*. This determination may be correct, but from Bocourt's description it would appear that *Centropomus mexicanus* had a dark lateral line and larger scales than *C. parallelus*.

*Centropomus mexicanus*, Bocourt, Ann. Sc. Nat. Paris, 1868, 90, Gulf of Mexico; Vaillant & Bocourt, Miss. Sci. Mex., 23, 1875, with plate.

### 1522. CENTROPOMUS PARALLELUS, Poey.

Head 2½; depth 3¾; eye small, 5. D. VIII–I, 10; A. III, 6; scales 85 to 90. Body moderately elongate, compressed so that the two sides of the body are parallel; an angle at front of anal. Mouth small; maxillary not quite reaching middle of eye. Subopercular flap reaching front of dorsal. Dorsal spines feeble, the longest 2 in head. Lateral line not black; 12 scales between second dorsal and lateral line. Serrations of preopercle directed slightly upward; 2 or 3 much stronger spines at the angle; suborbital toothed. Length of second anal spine equal to depth of body; third spine much shorter and very slender. Air bladder simple. Greenish above, sides silvery, with bright reflections; faint pale streaks along the rows of scales; ventrals and anal tipped with orange brown. A small species, rarely more than a foot long, found on the coasts of Cuba, entering lakes and streams. (Poey.) Also recorded from San Domingo, Jamaica, Barbados, and Rio Chagres, Guiana, Pernambuco, and Bahia. (*παράλληλος*, *parallelus*, parallel, the form being "slab-sided.")

*Centropomus parallelus*, Poey, Memorias, II, 120, 1860, Havana and Cienfuegos; Günther, Fishes Central Amer., 407, 1869; Boulenger, Cat., I, 369.

### 1523. CENTROPOMUS PECTINATUS, Poey.

Head 2½; depth 3¾; eye 6. D. VIII–I, 10; A. III, 7; scales 68. Body moderately elongate, compressed, with an angle at front of anal. Mouth small. Maxillary reaching anterior third of eye; angle of preopercle with about 6 long spines, slender and close-set, like the teeth of a comb; preorbital sharply serrate behind; second or third dorsal spine longest, 1⅔ in head; second anal spine as long as depth of body, 1½ in head; third slightly longer, but very slender. Air bladder simple. Plumbeous above, sides and belly white; center of each scale bluish, thus forming faint lines; fins greenish; lower lobe of caudal yellow. A small species (Poey; Boulenger), rarely more than a foot long, found on the coasts of Cuba, entering the lakes and rivers. Also recorded by Boulenger from San Domingo and Pernambuco. (*pectinatus*, comb-toothed.)

*Centropomus pectinatus*, Poey, Memorias, II, 122, 1860, Havana and Cienfuegos; Boulenger, Cat., I, 368.

### 1524. CENTROPOMUS UNIONENSIS, Bocourt.

Head 2⅔; depth 3¼; eye small, 6. D. VIII–I, 9; A. III, 6; scales 8–49–12. Body robust, back steeply elevated; base of anal angulated.

Profile more concave than in other species. Snout long, about 3 in head; maxillary not reaching middle of eye. Preopercle with 2 very strong teeth, other serrations very weak. Dorsal spines moderate, the longest not quite half head; anal spines long, the second $\frac{2}{3}$ depth of body, about half head, but little longer than third. Air bladder simple. Olivaceous, with faint streaks along the scales; upper fins brownish, ventrals pale; lateral line pale. Pacific coast of Central America; rather common at Panama; not recorded from Mazatlan; closely related to *Centropomus armatus* and to *C. ensiferus*, but apparently distinct from both. (From La Union.)

*Centropomus unionensis*, Bocourt, Ann. Sc. Nat. Paris, 1868, 90, La Union, San Salvador; Vaillant & Bocourt, Miss. Sci. Mex., 1875, 37; Boulenger, Cat., i, 370.

### 1525. CENTROPOMUS ARMATUS, Gill

Head $2\frac{1}{2}$; depth $3\frac{2}{5}$ to $3\frac{3}{4}$. D. VIII–I, 10; A. III, 6; scales 7–51–14, 10 to 14 scales before dorsal. Preorbital serrated in its hinder half; suboperculum produced into a long flap, which extends beyond the vertical from the origin of the dorsal fin. Premaxillary scarcely extending to below middle of orbit. Dorsal spines of moderate strength, the third longest, half as long as head; second anal spine exceedingly strong, much stronger than third and longer than third dorsal spine; ventral fin scarcely more than $\frac{1}{2}$ of distance of its base from anal. Air bladder simple. Silvery; dorsal fins, a blotch on the opercle, and the membrane between the anal spines blackish; lateral line not black. Length about a foot. Pacific coast of Central America, common from Chiapas to Panama. Dr. Boulenger refers this species, with its allies, *robalito* and *affinis*, to the synonymy of *Centropomus ensiferus*. Our Atlantic Coast material shows that *ensiferus* and *affinis* are very close to each other and doubtfully distinct from *robalito*, but certainly distinct from *armatus*. It is probable that *robalito* and *affinis* should be united with *ensiferus*. (*armatus*, armed.)

*Centropomus armatus*, Gill, Proc. Ac. Nat. Sci. Phila., 1863, 163, Panama; Günther, Fishes Central Amer., 408, 1869; Vaillant & Bocourt, Miss. Sci. Mex., 34, 1875.

### 1526. CENTROPOMUS ROBALITO, Jordan & Gilbert.

(Constantino; Robalito de las Aletas Amarillas.)

Head (with opercular flap) $2\frac{2}{3}$ in length; depth $3\frac{1}{2}$. D. VIII–I, 10; A. III, 6; scales 5–51–9; scales large, those in front of dorsal not crowded, 10 to 14 in number; 5 series between lateral line and front of spinous dorsal. Body comparatively elongate, the back little elevated; profile from snout to base of dorsal more nearly straight than in most of the species; upper outline of head somewhat concave; nuchal region little gibbous. Mouth smaller than in *C. armatus*, the maxillary barely reaching the vertical line from front of pupil (in *C. armatus* of the same size reaching past front of pupil), the gape contained nearly 3 times in length of head; snout long, longer than in *C. armatus*, $3\frac{1}{2}$ in head; eye moderate, a little more than half length of snout; preorbital with strong retrorse serræ. Top of head narrower than in *C. armatus* and more strongly ridged; the two interior ridges on the interorbital space separated by a space little wider than the nostril, coalescing opposite the nostrils and forming a single ridge for a little distance forward to near the base of the spines of the premaxillary. Preopercle with rather distant teeth of nearly equal size on the entire length of its vertical margin; similar teeth on the horizontal part, growing larger backward; about 2 teeth at the angle much longer and stronger than the others; suprascapula with 5 or 6 strong teeth; subopercular flap reaching about to front of spinous dorsal. Gill rakers long, about ⅔ diameter of orbit. Dorsal spines high and rather strong, but distinctly slenderer and more flexible than in *C. armatus*, their tips when depressed reaching considerably farther back than the tips of the pectorals or ventrals; third spine longest, a little less than half length of head; fourth spine but little shorter than third; insertion of first dorsal spine a trifle nearer last ray of second dorsal than tip of snout; second anal spine very long and strong and straight or more or less curved, its length and form very variable, its tip about reaching base of caudal; much longer than third dorsal spine or than third anal spine, and about 1½ in length of head; third anal spine about equal to first soft ray; caudal fin well forked; ventral fins long, reaching in most cases scarcely to the vent; pectorals about equaling ventrals, 1⅔ in length of head, not reaching tips of ventrals. Vent about midway between base of ventrals and middle of base of anal. Color bluish, olivaceous, silvery white below; lateral line pale; membrane of anterior dorsal spines and of second and third anal spines blackish; pectorals and soft parts of vertical fins somewhat dusky; ventral plain bright yellow; anal with more or less of bright yellow. Length about 1 foot. Pacific coast of Mexico from Mazatlan to Panama; generally common, especially about Mazatlan, where it enters the streams in abundance. Probably not distinct from *C. ensiferus*. (*Robalito*, the vernacular name; diminutive of *Robalo*.)

*Centropomus robalito*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1881, 462, Mazatlan; Acapulco. (Types, Nos. 28102, 28132, 28150, etc. Coll. Gilbert.)

### 1527. CENTROPOMUS AFFINIS, Steindachner.

Head 2⅗; depth 3½; eye large, 4 in head. D. VIII–I, 10; A. III, 6; scales 7–46–11 (Vaillant), 7–47 to 50–10 or 11 (Steindachner). Snout depressed, its profile a little concave; back not much elevated; sides compressed, parallel; line of belly straight. Maxillary reaching to first third of eye; suborbital with 5 or 6 small teeth; preopercle with 2 large triangular teeth at angle, the other teeth strong; subopercular flap reaching base of first dorsal spine. Scales large, those before dorsal small. Suprascapula with 4 teeth. Ventral reaching more than half way to anal; pectoral 1⅔ in head; third dorsal spine 1⅔ in depth of body, about 2½ in head; second anal spine notably longer than third, its length 1⅗ in head, ⅒ greater than depth of body; caudal a little shorter than head. Coloration olive; sides silvery; black shades on vertical fins, especially behind anal spines. Lateral line brown; ventrals pale. (Vaillant & Bocourt.) Coast of Brazil, north to Belize; evidently very close to *Centropomus ensiferus*, to which Dr. Boulenger refers it. (*affinis*, related, to *Centropomus undecimalis.*)

*Centropomus affinis*, STEINDACHNER, Ichth. Notizen, I, pl. 1, fig. 1, 1864, Rio Janeiro and Cajutuba, Brazil; Demerara, (Coll. Johann Natterer); VAILLANT & BOCOURT, Miss. Sci. Mex., 31, pl. 1, fig 1.

*Centropomus scaber*, BOCOURT, Ann. Sci. Nat., 5 Ser., IX, 90, 1868, marshes of Belize. (Coll. Bocourt).

### 1528. CENTROPOMUS ENSIFERUS, Poey.

Head 2½; depth 4; eye 6½ in head. D. VIII–I, 10; A. III, 6; scales 7–53–11, pores 48. Preorbital coarsely serrated; subopercular flap extending to vertical from origin of dorsal. Maxillary scarcely extending to below middle of orbit. Dorsal spines of moderate strength, the third and fourth longest, ⅖ as long as head; second anal spine exceedingly strong, much stronger than third, 1⅗ times depth of body, much longer than dorsal spines; ventral somewhat more than ½ the distance of its base from anal. Silvery; dorsal fin, a blotch on the opercle, and the membrane between the anal spines blackish; lateral line not black. Air bladder simple. Length about a foot. West Indies; generally common from Cuba to Surinam; also found on the Pacific Coast, if *C. robalito* is the same, which is not unlikely. (*ensis*, sword; *fero*, I bear.)

*Centropomus ensiferus*, POEY, Memorias, II, 122, 1860, Havana; GÜNTHER, Fishes Central Amer., 408, 1869; BOULENGER, Cat., I, 369.

? *Centropomus brevis*,* GÜNTHER, Proc. Zoöl. Soc. Lond., 1864, 144, locality unknown.

For the sake of completeness, we add the description of the only remaining species of this genus which is known to us:

*Centropomus constantinus*, Jordan & Starks, new species.—Head 2¾; depth 3½; eye 5 in head; snout 3½; interorbital ⅔ eye; D. VIII–I, 10; A. III, 6; scales 10–67–13. Posterior half of preorbital rather strongly retrorse-serrate; anterior portion entire; maxillary extending to below the middle of orbit, 2⅓ in head; subopercular flap extending nearly to within 4 scales of the vertical from the origin of dorsal. Gill rakers 4 + 9; 21 series of scales before first dorsal. Third and fourth dorsal spines equal, about half as long as head; second anal spine longer and much stronger than third, 1⅔ in head; third longer than soft rays; ventrals long, 1⅓ in head, nearly reaching vent, their length not quite equal to distance from their tips to anal. Air bladder with very short, blunt anterior appendages, which are not more than half the length of the pupil. Pectorals 2 in head; caudal short, with roundish lobes, 2 in head. Olive; sides silvery; lateral line dusky; head pale; ventrals pale; tips of dorsal and membrane behind anal spines blackish. Allied to *C. mexicanus*, but the dorsal spines more slender and shorter and the body deeper. Known from 3 specimens collected at Bahia, Brazil, by the *Albatross*. The one here described is 8¼ inches long and numbered 1633 on the register of Stanford University. Two others are in the U. S. National Museum, numbered 43289. (*Constantino*, a Spanish vernacular name of the smaller *Robalos* or *Robalitos*.)

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* *Centropomus brevis*, Günther: Head 2½; depth 3½. D. VIII–I, 10; A. III, 6; scales 8–50–X. Maxillary reaching to middle of eye; suborbital strongly toothed; lobe of subopercle reaching beyond front of dorsal. Vent much nearer anal than ventrals. Dorsal spines strong, the third equal to distance from chin to posterior border of eye; second anal spine strong, 1½ in head, greater than depth of body; third anal spine much shorter. Air bladder simple. Lateral line pale; lower fins pale Locality unknown. (Günther.) This may be a species distinct from *Centropomus ensiferus*, having deeper body and smaller scales. Its validity is, however, very doubtful. Dr. Boulenger, who has examined its type, as well as specimens certainly referable to *robalito* (Presidio, Forrer), to *armatus* (Panama, Salvin), and *ensiferus* (Jamaica), regards them all as identical. *C. armatus* is certainly valid, but the others may all be identical with *ensiferus.*

## Family CXLVI. SERRANIDÆ.

### (THE SEA BASS.)

Body oblong, more or less compressed, covered with adherent scales of moderate or small size, which are usually but not always ctenoid; dorsal and ventral outlines usually not perfectly corresponding. Mouth moderate or large, not very oblique, the premaxillary protractile and the broad maxillary usually not slipping for its whole length into a sheath formed by the preorbital, which is usually narrow. Supplemental maxillary present or absent. Teeth all conical or pointed, in bands, present on jaws, vomer and palatines. Gill rakers long or short, usually stiff, armed with teeth. Gills 4, a long slit behind the fourth. Pseudobranchiæ present, large. Lower pharyngeals rather narrow, with pointed teeth, separate (except in *Centrogenys*). Gill membranes separate, free from the isthmus. Branchiostegals normally 7 (occasionally 6). Cheeks and opercles always scaly; preopercle with its margin more or less serrate, rarely entire; the opercles usually ending in one or two flat spine-like points. Nostrils double. Lateral line single, not extending on the caudal fin. Skull without cranial spines and usually without well-developed cavernous structure. No suborbital stay. Post-temporal normal. Second suborbital with an internal lamina supporting the globe of the eye; entopterygoid present; all or most of the ribs inserted on the transverse processes when these are developed; anterior vertebræ without transverse processes. Dorsal spines usually stiff, 2 to 15 in number; soft dorsal with 10 to 30 rays; anal fin rather short, its soft rays 7 to 12, its spines, if present, always 3, in certain genera (*Grammistinæ*, *Rypticinæ*) altogether wanting. Ventrals thoracic, usually I, 5 (I, 4, in *Plesiopinæ*), normally developed, without distinct axillary scale. Pectorals well developed, with narrow base, the rays branched. Caudal peduncle stout, the fin variously formed. Vertebræ typically $10 + 14 = 24$, the number sometimes increased, never more than 35.* Air bladder present, usually small,

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* The following account of the numbers of vertebræ is taken from Dr. Boulenger's Catalogue of Teleostean Fishes; the nomenclature of certain species is changed to agree with that of the the present work:

| | | | |
|---|---|---|---|
| Percichthys trucha | $15 + 20 = 35$ | Acanthistius serratus | $10 + 16 = 26$ |
| Percichthys pocha | $14 + 19 = 33$ | Hemilutjanus macrophthalmus | $10 + 15 = 25$ |
| Percilia gillissii | $13 + 22 = 35$ | Centrogenys vaigiensis | $11 + 14 = 25$ |
| Lateolabrax japonicus | $17 + 18 = 35$ | Polyprion americanus | $13 + 14 = 27$ |
| Niphon spinosus | $14 + 17 = 31$ | Polyprion prognathus | $14 + 13 = 27$ |
| Morone americana | $12 + 13 = 25$ | Oligorus macquariensis | $16 + 19 = 35$ |
| Roccus chrysops | $12 + 13 = 25$ | Aulacocephalus temminckii | $10 + 14 = 24$ |
| Dicentrarchus labrax | $12 + 13 = 25$ | Plectropoma maculatum | $10 + 14 = 24$ |
| Percalates colonorum | $11 + 14 = 25$ | Variola louti | $10 + 14 = 24$ |
| Ctenolates ambiguus | $11 + 15 = 26$ | Bodianus guttatus | $10 + 14 = 24$ |
| Siniperca chuatsi | $13 + 15 = 28$ | Bodianus punctatus | $10 + 14 = 24$ |
| Acanthistius pictus | $10 + 16 = 26$ | | |

and adherent to the wall of the abdomen. Stomach cæcal, with few or many pyloric appendages; intestines short, as is usual in carnivorous fishes. Genera 60 to 70. Species about 400.† Carnivorous fishes, chiefly marine, and found in all warm seas; several genera found in fresh waters. As here understood, the *Serranidæ* comprise the most of the family of *Percidæ* as understood by Günther and others, exclusive of those with imperfect pseudobranchiæ, those with one or two anal spines, those with the number of vertebræ increased, those in which the whole length of the maxillary slips under the preorbital, and those with the anal fin many rayed, and the cranium shortened behind. As here understood, the *Serranidæ* are essentially equivalent to the *Serraninæ* and *Grammistinæ* of Boulenger's Catalogue. Even after these eliminations, the family is considerably varied. (*Percidæ*, part, Günther, Cat., I, 61–220.)

I. Anal spines 3, well developed.

*a.* Dorsal fins 2; vertebræ 25 to 36, 11 to 15 in precaudal portion.

MORONINÆ:

*b.* Maxillary without supplemental bone; teeth all pointed; pectoral unsymmetrical, its upper rays longest; dorsal (in our genera) X–14; skull without cavernous structure; preopercle strongly serrate; caudal fin forked; tongue with teeth; ventral fins inserted behind axil of pectorals; teeth all alike, usually villiform, without canines; preorbital narrow; lateral line normal, straight, or bent upward at base; preopercle serrate; gill rakers moderately long and slender; species generally of large size, and silvery-olive coloration, mostly inhabiting fresh or brackish waters. Preopercle without antrorse spines on its lower limb.

*c.* Dorsal fins separate; spines of fins weak; anal rays III, 12, the spines graduated; lower jaw projecting; base of tongue with teeth. ROCCUS, 491.

*cc.* Dorsal fins joined; spines of fins strong; anal rays III, 9, the spines not graduated; jaws subequal; base of tongue toothless. MORONE, 492.

*aa.* Dorsal fin single, sometimes deeply divided.

*d.* Maxillary with a distinct supplemental bone (rarely obscured by the skin); dorsal usually divided or deeply notched.

*e.* Inner teeth of jaws not depressible or hinged.

LIOPROPOMINÆ:

*f.* Soft dorsal longer than spinous part; dorsal deeply divided, the spines 6 to 9 in number; preopercle entire; vertebræ 10 + 14 = 24; lateral line arched anteriorly.

*g.* Dorsal spines 9; caudal lunate. LIOPROPOMA, 493.

*gg.* Dorsal spines 6; caudal truncate. CHORISTISTIUM, 494.

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|---|---|---|---|
| Bodianus tæniops | 10 + 14 = 24 | Serranus cabrilla | 10 + 14 = 24 |
| Epinephelus areolatus | 10 + 14 = 24 | Serranus scriba | 10 + 14 = 24 |
| Epinephelus striatus | 10 + 14 = 24 | Gilbertia semicincta | 10 + 17 = 27 |
| Epinephelus fasciatus | 10 + 14 = 24 | Cæsioperca lepidoptera | 10 + 16 = 26 |
| Epinephelus tauvina | 10 + 14 = 24 | Caprodon longimanus | 10 + 16 = 26 |
| Promicrops guttatus | 10 + 14 = 24 | Holanthias borbonius | 10 + 16 = 26 |
| Alphestes afer | 10 + 14 = 24 | Anthias sacer | 10 + 16 = 26 |
| Mycteroperca bonaci | 10 + 14 = 24 | Plectranthias anthioides | 10 + 16 = 26 |
| Anyperodon leucogrammicus | 10 + 14 = 24 | Callanthias peloritanus | 11 + 13 = 24 |
| Paranthias furcifer | 10 + 14 = 24 | Paraplesiops meleagris | 10 + 16 = 26 |
| Parolabrax humeralis | 10 + 14 = 24 | Plesiops nigricans | 10 + 15 = 25 |
| | | Rypticus saponaceus | 10 + 14 = 24 |

† A review of the genera and species of *Serranidæ* found in the waters of America and Europe, by David Starr Jordan and Carl H. Eigenmann, was published in Bulletin VIII of the U. S. Fish Commission, 1888 (1890), 329–433, plates 60 to 69. In that paper may be found full synonymy of all the genera and species. A most excellent account is given in Boulenger's Catalogue of Teleostean Fishes, Vol. I, just published as these pages are going through the press.

Polyprioninæ:

*ff.* Soft dorsal shorter than spinous part; vertebræ more than 24 (25 to 36); head without rugose dermal ossifications.

*h.* Teeth all villiform, without canines; soft dorsal with 10 to 12 rays.

*i.* Head not armed with spinigerous ridges; preopercle moderately serrate, sometimes becoming entire with age; dorsal fin deeply notched, the last spines much shorter than the middle ones; scales rugose; soft dorsal scaly; dorsal spines 11; tongue toothless; forehead broad, flattish; snout, preorbital, and jaws naked; caudal subtruncate; preopercle finely serrate, becoming entire with age; gill rakers very strong; pyloric cœca few (about 7); pectoral obtusely pointed; ventral inserted a little before axil of pectoral; vertebræ 26. Stereolepis, 495.

*ii.* Head armed with rough spinigerous crests, there being spinous projections above the eyes and a rough, bony ridge on the opercle, with others on the post-temporal; dorsal fin low, continuous; tongue with teeth; dorsal spines 11 or 12; soft dorsal scaly; caudal rounded; ventral not inserted before axil of pectoral; pyloric cœca numerous (about 70); vertebræ 27. Polyprion, 496.

Epinephelinæ:

*ee.* Inner teeth of jaws depressible or hinged; canine teeth more or less distinct, in front of each jaw; scales small, firm, the top of head more or less scaly; lateral line running low (except in *Gonioplectrus*, etc.); supraoccipital crest usually more or less encroaching on the top of the skull, so as to leave no distinct smooth area at the vertex (except in *Variola*); temporal crests usually distinct; gill rakers various, generally small and short. Dorsal rays VIII to XIV, 12 to 20, the number of spines usually not 10; anal rays III, 7 to III, 12; ventral fins inserted more or less behind axil of pectorals; head unarmed, except for the opercular spines and the serræ on the preopercle; soft dorsal scaly; scales of lateral line usually triangular and cycloid; vertebræ almost always $10 + 14 = 24$, rarely 26 or 27. Chiefly shore fishes, often of large size; all of them, so far as known, bisexual.

*j.* Pectoral unsymmetrical, its upper rays longest; dorsal spines 8; plectroid spine on preopercle single, very strong; a strong canine on middle of side of lower jaw; opercle with a long, knife-shaped spine; body rather deep; lateral line running high; jaws naked; scales small, firm, and rough; caudal rounded; soft dorsal rather short, of 12 or 13 rays. Gonioplectrus, 497.

*jj.* Pectoral rounded, symmetrical, its middle rays longest; canines usually distinct, in front of 1 or both jaws.

*k.* Frontals* with a transverse ridge on posterior part in front of the supraoccipital connecting the parietal crests; frontal bones without processes or longitudinal ridges on the upper surface; dorsal spines always 9.

*l.* Posterior process of premaxillary extending to between frontals; mandible without curved canines on its sides; caudal not forked; scales ctenoid. Petrometopon, 498.

*kk.* Frontals without transverse ridge.

*m.* Dorsal spines 9; soft dorsal of moderate length and height, its rays 13 to 15; anal rays III, 7 or 8; skull and head essentially as in *Ephinephelus*, the snout not very short, the frontal region flat or convex, the supraoccipital crest continued forward over it, the lateral crest short, low, and diverging; mouth and teeth as in *Ephinephelus*. Bodianus, 499.

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*These characters, with other osteological characters used in this analysis, are taken from Boulenger's Catalogue, p. 165 et seq.

*mm.* Dorsal spines 11, (rarely 10, never 9).

*n.* Parietal crests not produced forward on the frontals; frontals with a process or knob on each side, behind interorbital area; premaxillary processes fitting into a cavity at the anterior extremity of the frontals, or into an emargination of these bones; anal rays III, 8, or III, 9.

*o.* Scales of the lateral line normal, marked by radiating ridges.

*p.* Cranium narrow above the interorbital space, deeply concave; occipital crest meeting interorbital region. EPINEPHELUS, 500.

*pp.* Cranium very broad and flat above, the interorbital little concave, the occipital crest disappearing before reaching interorbital region. GARRUPA, 501.

*oo.* Scales of the lateral line each with 4 to 6 strong radiating ridges; cranium short, extremely broad, and depressed between the eyes; the anterior profile of head a little concave; dorsal spines low; dorsal rays XI, 16. PROMICROPS, 502.

*nn.* Parietal crests produced forward on the frontals.

*q.* Frontals with a process or knob on each side behind the interorbital area; premaxillaries fitting into a cavity at anterior extremity of frontals; anal rays III, 8, rarely III, 9.

*r.* Preopercle with a single antrorse hook or spine near the angle; supraoccipital and parietal crests not extending to between orbits; scales ctenoid. ALPHESTES, 503.

*rr.* Preopercle without antrorse spine; supraoccipital and parietal crests extending to between orbits; scales smooth; canine teeth small or obsolete; head small much compressed, the interorbital area in the adult not broader than the eye; supraoccipital crest low; soft dorsal unusually long, the rays XI, 17 to 20; dorsal spines low; vertical fins all rounded posteriorly. DERMATOLEPIS, 504.

*qq.* Frontals without processes on the upper surface; parietal crests extending to between orbits; premaxillary processes not extending to the frontals. Anal fin elongate, its rays III, 11 or III, 12, (very rarely III, 9 or III, 10); caudal fin lunate or truncate; spines slender, those of the anal fin graduated; lower jaws strongly projecting; cranium rather broad and transversely concave between the eyes, its lateral crests very strong, nearly parallel with the supraoccipital crest and extending farther forward than the latter, joining the supraocular crest above the eye; scales small, largely cycloid, those of the lateral line simple; pyloric cœca few (12 to 20); dorsal rays XI, 16 to 18. MYCTEROPERCA, 505.

***dd.*** **Maxillary without supplemental bone; canine teeth, if present, usually developed on the side of the lower jaw as well as in front; no depressible teeth; scales mostly ctenoid, including those of the lateral line; tubes of lateral line straight or with an ascending tubule, covering most of the length of scale. Temporal crests on cranium almost obsolete.**

**SERRANINÆ:**

*s.* Gill rakers comparatively short and wide apart; lateral line not running close to the back (except in *Serranus*); dorsal rays X, 11 to 15; anal rays usually III, 7; supraoccipital crest not extending far forward on top of the skull. a more or less distinct convex smooth area being left on the vertex between the supraoccipital and the interorbital area; mouth not very oblique; vertebræ about $10 + 14 = 24$. Chiefly shore fishes of olivaceous colors.

*t.* Ventral fins inserted below or more or less behind axil of pectoral; branchiostegals 7.

*u.* Dorsal fin with 4 or 5 spines produced in long filaments; dorsal rays X, 12, or X, 13; preopercle evenly serrate; preorbital comparitively broad; top of head, cheeks, and preorbital finely and closely scaled to the tip of snout; snout long and low, the lower jaw much projecting; caudal lunate; scales rather small; cranium with a large smooth area, much as in *Serranus* and *Prionodes*, body elongate, little compressed; gill rakers few and short. CRATINUS, 506.

*uu.* Dorsal without long filamentous spines, not more than one of its spines specially produced.

*v.* Body short and deep, with elevated back, the depth more than $\frac{2}{5}$ the length, usually nearly half; preopercle with a few antrorse serræ on its lower limb; top of supraoccipital crest very high, about as long as the smooth area on vertex of cranium, which is well developed, as in *Serranus* and *Prionodes*. Top of head naked; dorsal rays usually X, 14. HYPOPLECTRUS, 507.

*vv.* Body comparatively elongate, the depth $\frac{1}{3}$ to $\frac{1}{4}$ the length; no hooked spinules on lower limb of preopercle.

*w.* Cranium with its smooth area very short and small, much as in *Centropristes*; caudal fin more or less distinctly lunate or concave, the middle rays shortest; dorsal spines strong, very unequal, the third or fourth more or less elevated; (scales small; dorsal rays X, 14; top of head usually more or less scaly). PARALABRAX, 508.

*tt.* Ventral fins anterior, inserted more or less in advance of axil of pectoral, well separated; upper half of pectoral fin usually vertically truncate.

*x.* Smooth area on top of cranium very short and small*; the long supraoccipital crest encroaching on the posterior border of cranium so that the latter in profile is not nearly vertical along the occipital region. Branchiostegals 7. Caudal fin not lunate, rounded, or ending in 3 points, the middle rays produced like the outer ones; dorsal spines slender, the third little elevated, some of them with dermal appendages or filaments (teeth small, in broad bands; top of head naked; scales large, dorsal rays X, 11). CENTROPRISTES, 509.

*xx.* Smooth area on top of cranium* very large, longer than the low supraoccipital crest, which is low and short; posterior border of cranium at occipital region nearly vertical in profile. Caudal fin lunate or truncate; dorsal rays X, 11 to X, 13; soft dorsal scaleless or nearly so. Canine teeth small.

*y.* Branchiostegals 7; caudal fin forked or lunate; none of the dorsal spines elongate.

*z.* Preopercle with numerous strong diverging spines at its angle, these spines diverging from one or two centers; preorbital broader than maxillary, which is widest near its middle; scales rather large. DIPLECTRUM, 510.

*zz.* Preopercle simply and rather finely serrate; preorbital narrow. PRIONODES, 511.

*yy.* Branchiostegals 6; caudal fin truncate. DULES, 512.

*ss.* Gill rakers (in American species) very long, slender, and close set; lateral line running close to the back; supraoccipital crest high; occiput with a short convex smooth area; canines strong; no depressible teeth; preorbital narrow; maxillary without supplemental bone or with a rudiment only.

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* Seen on removal of skin of vertex.

**Anthiinæ:**

*a'*. Lateral line complete and continuous, extending to base of caudal; ventral rays I, 5; dorsal rays IX to XII, 9 to 20; anal rays III, 7 to 10; pectoral rays branched; snout short, mostly convex in profile; fishes of rather deep waters, chiefly bright red in life.

*b'* Dorsal spines 9, all low, the soft rays about 19. Caudal fin deeply forked, the lobes produced; scales small, ctenoid; ventrals long, inserted behind axil of pectoral; maxillary scaly; frontal region flattish, the supraoccipital crest very prominent. Paranthias, 513.

*bb'*. Dorsal spines 10 or more; scales not very small· preopercle angular, with salient teeth at its angle; one or more dorsal spines sometimes filamentous; ventral fins long.

*c'*. Maxillary and frontal region naked; tongue mostly toothless; caudal fin lunate; parietals weak; posterior process of premaxillary reaching the frontals.

*d'*. Ventrals inserted behind axil of pectoral; scales 50 to 60. Hemianthias, 514.

*dd'*. Ventrals inserted before axil of pectoral; scales 38 to 45. Pronotogrammus, 515.

*cc'*. Maxillary scaly; top of head scaled to the snout.

*e'*. Pterygoids toothless; tongue with few teeth or none; caudal forked. Anthias, 516.

*ee'*. Pterygoids with a large patch of teeth; tongue toothed; parietal crest strong, extending to above eye; posterior processes of premaxillary not reaching the frontals; caudal truncate, with the outer rays much produced. Ocyanthias, 517.

*aa'*. Lateral line interrupted, running close to the back, beginning again on caudal peduncle.

**Gramminæ:**

*f'*. Ventral rays I. 5;* preopercle serrate; caudal convex; scales rather large, somewhat ctenoid; dorsal spines 12. Gramma, 518.

**Rypticinæ:**

*II*. Anal spines wanting; dorsal spines 2 to 4 only; soft dorsal and anal long, the dorsal of 20 to 26 soft rays; the anal of 14 to 17; maxillary with a supplemental bone; the preopercle with 2 or 3 spine-like hooks posteriorly, the scales small and embedded, the teeth all villiform; preorbital narrow, no canine teeth; preopercle without angle or serratures, its margin with 2 or 3 spinous teeth above; caudal fin rounded; scales small, smooth, embedded; smooth area on top of head very large, transversely convex, much longer than the low supraoccipital crest; interorbital area very narrow; temporal ridges strong; lateral line normal; vertebræ 10 + 14. Rypticus, 519.

## 491. ROCCUS, Mitchill.

### (Striped Bass.)

*Roccus*, Mitchill, Fishes of New York, 25, 1814, (*striatus* = *lineatus*).
*Lepibema*, Rafinesque, Ichthyologia Ohiensis, 23, 1820, (*chrysops*).

Base of tongue with 1 or 2 patches of teeth; anal spines graduated; dorsal fins entirely separate; anal rays III, 11 or 12; supraoccipital crest scarcely widened above; lower jaw projecting. Vertebræ 12 + 13 = 25. Otherwise as in *Morone*, the body more elongate, the scales smoother, and the fin spines more slender than in the latter genus. Anal fin with 11 or 12 soft rays. Species all American, valued as food-fishes. In both *Roccus* and *Morone*, the antrorse preopercular spines (characteristic of the European genus or subgenus *Dicentrarchus*) are wanting. (From the vernacular, Rockfish.)

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*The related group of *Plesiopinæ* (*Plesiops*, *Paraplesiops* and *Trachinops*) have the ventral rays I, 4 only. It may be that they do not belong to the *Serranidæ*, in which case *Gramma* should probably be detached also.

LEPIBEMA (λεπίς, scale; βῆμα, a staircase, from the scales at base of dorsal):

*a.* Teeth on base of tongue in a single patch; body rather deep and compressed, the depth more than ⅓ the length; back arched.

*b.* Color whitish with several narrow dusky lateral stripes following the rows of scales; second anal spine about 3 in head. CHRYSOPS, 1529.

ROCCUS:

*aa.* Teeth on base of tongue in 2 parallel patches; body rather elongate, the depth less than ⅓ the length; back not arched.

*bb.* Color brassy or greenish, sides with 7 or 8 continuous dark stripes; second anal spine 5 in head. LINEATUS, 1530.

## Subgenus LEPIBEMA, Rafinesque.

### 1529. ROCCUS CHRYSOPS (Rafinesque).

(WHITE BASS; WHITE LAKE BASS.)

Head 3½; depth 2½; eye 5 in head; snout 4⅓. D. IX–I, 14; A. III, 11 or 12; scales 10–55 to 65–15, 53 to 61 pores. Body rather deep and compressed, the depth more than ⅓ the length; back considerably arched; head subconical, slightly depressed at the nape; mouth moderate, nearly horizontal, the lower jaw little projecting; eye large, nearly as long as snout; maxillary reaching middle of pupil, 2¾ in head; teeth on base of tongue in a single patch, a patch also on each side of tongue; margin of subopercle with a deep notch; head scaled to between nostrils; preopercular serræ feeble, strongest at the angle; gill rakers rather long and slender, x + 14, as long as gill fringes; longest dorsal spine 2 in head; anal spines graduated; second anal spine 3; middle caudal rays 1⅔ in outer. Color silvery, tinged with golden below; sides with narrow dusky lines, about 5 above the lateral line, 1 along it, and a variable number below it, these sometimes more or less interrupted or transposed. Length 15 inches. Great Lake region, upper Mississippi and Ohio valleys, south to Washita River; not found east of the Alleghanies nor in salt water; rare in the Ohio Valley; generally abundant in the Great Lakes. It frequents deep or still waters, seldom ascending small streams. (χρυσός, gold; ὤψ, eye.)

*Perca chrysops*, RAFINESQUE, Ichthyologia Ohiensis, 22, 1820, Falls of the Ohio.

*Labrax multilineatus*, CUVIER & VALENCIENNES, Hist. Nat. des Poissons, III, 488, 1830, Wabash River; GÜNTHER, Cat., I, 67, 1859.

*Labrax notatus* (HAMILTON SMITH) RICHARDSON, Fauna Boreali-Americana, III, 8, 1836, Lower St. Lawrence River; GÜNTHER, Cat., I, 67, 1859.

*Labrax albidus*, DE KAY, Nat. Hist. N. Y.: Fishes, 13, pl. 51, fig. 165, 1842, Buffalo.

*Labrax osculatii*, FILIPPI, Rev. et. Mag. de Zoologie, 2d series, V, 164, 1853, Canada; GÜNTHER, Cat., I, 65.

*Roccus chrysops*, GILL, Ichth. Rep. Captain Simpson's Surv. Great Basin Utah, 391, pl. 1, figs. 1-7, 1876; JORDAN & EIGENMANN, *l. c.*, 422, 1890.

*Morone multilineata*, BOULENGER, Cat., I, 128.

## Subgenus ROCCUS.

### 1530. ROCCUS LINEATUS (Bloch).

(STRIPED BASS; ROCKFISH; ROCK.)

Head 3¼ to 3½; depth 3½ to 4, varying considerably with age, the young being more slender. D. IX–I, 12; A. III, 11; scales 8–67–11. Body rather elongate, little compressed, the depth less than ⅓ the length; back little arched; head subconical; mouth large, oblique, the maxillary reaching to nearly below middle of orbit, 2½ in head, its width at tip nearly ⅔ diameter of eye; teeth on base of tongue in two parallel patches; interorbital space wide; lower jaw projecting; eye ½ to ⅔ the length of the rather sharp snout, 5 to 7 in head; preorbital entire; preopercle rather weakly serrate, the teeth strongest at the angle; margin of subopercle entire; suprascapula entire; gill rakers long and slender, about 4 + 15; dorsal fins entirely separated; spines slenderer than in allied species; longest dorsal spine 2⅓ in head; anal spines graduated; second anal spine 5 to 6 in head; Caudal forked, the middle rays ⅗ length of outer. Color olivaceous, silvery, often brassy-tinged; sides paler, marked with 7 or 8 continuous or interrupted blackish stripes, one of them along the lateral line; fins pale. Atlantic coast of the United States, from New Brunswick to the Escambia River, Florida, ascending all rivers in spring for the purpose of spawning; rather rare in the Gulf of Mexico; most common from Cape Cod to Cape May; occasionally in Lake Ontario. Introduced by the U. S. Fish Commission into Sacramento River and elsewhere on the west coast, where it has become an abundant and valuable food-fish. This species is one of the most important of the game and food-fishes of America. It is very abundant throughout its range and reaches a large size, often weighing 30 to 90 pounds. The largest one ever reported, according to Goode, was taken at Orleans, Massachusetts, and weighed 112 pounds. Its flesh is firm, white, flaky, and of excellent flavor. (*lineatus*, striped.)

*Perca Rock-fish* vel *Striped Bass*, SCHÖPF, Schrift. der Gesells. Nat. Freunde, VIII, 160, 1788, New York.

*Perca saxatilis*, WALBAUM, Artedi Genera Piscium, 330, 1788, New York; after SCHÖPF.

*Sciæna lineata*, BLOCH, Ichthyologia, IX, 53, pl. 305, 1792, Mediterranean Sea; figure incorrect, but probably from an American specimen.

*Perca septentrionalis*, BLOCH & SCHNEIDER, Systema Ichthyol., 90, pl. 70, 1801, New York.

*Roccus striatus*, MITCHILL, Rep. Fishes N. Y., 25, 1814, specimens from New York.; BEAN, Proc. U. S. Nat. Mus., 1884, 243, specimens from Montgomery, Alabama.

*Perca mitchilli*, MITCHILL, Trans. Lit. and Phil. Soc. N. Y., I, 413, pl. 3, fig. 4, 1815, New York.

*Perca mitchilli alternata*, MITCHILL, *l. c.*, 415, 1815, New York.

*Perca mitchilli interrupta*, MITCHILL, Trans. Lit. and Phil. Soc. N. Y., 415, 1815, New York.

*Lepibema lineatum*, STEINDACHNER, Verh. Zool. Bot. Ges. Wien., XII, 1862, 504.

*Lepibema mitchilli*, RAFINESQUE, Ichthyologia Ohiensis, 23, 1820.

*Labrax lineatus*, CUVIER & VALENCIENNES, Hist. Nat. des Poissons, II, 79, 1828.

*Roccus lineatus*, GILL, Ichth. Rep. Capt. Simpson's Expl. Great Basin Utah, 391, 1876; GOODE, Nat. Hist. Aquat. Anim., 425, 1884.

*Roccus saxatilis*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 599.

*Roccus lineatus*, JORDAN & EIGENMANN, *l. c.*, 423, 1890.

*Morone lineata*, BOULENGER, Cat., I, 129.

## 492. MORONE, Mitchill.

### (WHITE PERCH.)

*Morone*, MITCHILL, Fishes of New York, 18, 1814, (*rufa* and *flavescens*: the genus properly a synonym of *Perca*).

*Morone*, GILL, Proc. Ac. Nat. Sci. Phila., 1860, 111, (restriction to *americana* = *rufa*).

Body rather short and deep, compressed; maxillary broad, naked, without supplemental bone; teeth subequal, lower jaw scarcely projecting; no canines; no movable teeth; base of tongue without teeth, edge of tongue with linear patches of teeth. Lower margin of preopercle simply serrate or entire, the serræ not greatly increased in size toward the angle, and none of them developed as antrorse hooks. Spines strong, 10 in the dorsal fin; dorsal fins more or less connected by membrane; second anal spine much enlarged, not shorter than third; anal rays III, 8 or 9; lower margin of preopercle finely serrate, without antrorse spines. Lower jaw slightly projecting; vertebræ 12 + 13 = 25. Scales rather large, ctenoid; top of head scaly; lateral line little arched. Ventrals inserted well behind pectorals. Two known species, both American. (Name unexplained.)

*a.* Longest dorsal spine considerably more than half head; color brassy yellow, with 7 very distinct longitudinal black lines, interrupted posteriorly; dorsal fins slightly connected; spines all very robust. INTERRUPTA, 1531.

*aa.* Longest dorsal spine about half head; color green or olivaceous and silvery with faint streaks; dorsal fins well connected; spines moderate. AMERICANA, 1532.

### 1531. MORONE INTERRUPTA, Gill.

(Yellow Bass.)

Head 3; depth 2⅔. D. IX–I, 12; A. III, 9 or 10; scales 7–50 to 54–11. Body oblong, ovate, the back much arched; head depressed, the snout somewhat pointed, the anterior profile concave; eye large, as long as snout, 4½ in head; preorbital finely serrate; suprascapula serrate; mouth small, somewhat oblique, the maxillary reaching middle of orbit, about 3 in head; maxillary somewhat scaly; gill rakers moderate, x + 13 to 16, longer than gill fringes; dorsal and anal spines very robust, the longest dorsal spine 1⅗ to 1⅔ in head, the longest anal spine 2 to 2½; dorsal fins slightly connected. Color in life brassy yellow, with about 7 very distinct longitudinal black lines, those below the lateral line interrupted posteriorly, the posterior part alternating with the anterior. Length 15 inches. Lower Mississippi Valley, north to Cincinnati and St. Louis, chiefly in the channels of the larger streams; rather common southward; a good food-fish. (*interruptus*, interrupted, referring to the longitudinal black lines.)

*Morone interrupta*, Gill, Proc. Ac. Nat. Sci. Phila., 1860, 118, St. Louis; New Orleans: Gill, Ichth. Rep. Capt. Simpson's Sur. Great Basin Utah, 398. pl. 2, figs. 1–8, 1876, Jordan & Gilbert, Synopsis, 530, 1883; Jordan & Eigenmann, *l. c.*, 420, 1890.

*Morone mississippiensis*, Jordan & Eigenmann, Proc. Ac. Nat. Sci. Phila., 1887 (substitute name for *interrupta*, regarded as preoccupied, as it has been used for a species of *Roccus*, a genus at that time merged in *Morone*); Boulenger, Cat., I, 127.

### 1532. MORONE AMERICANA (Gmelin).

(White Perch.)

Head 2¾ to 3; depth 2½ to 3. D. IX–I, 12; A. III, 8 or 9; scales 8–50 to 55–12, 50 to 55 pores. Body oblong, ovate, the back moderately elevated; head depressed above eyes; the snout rather pointed; mouth small, somewhat oblique, the maxillary not reaching middle of orbit, 2⅘ in head, its width at tip half eye; preorbital entire; eye moderate, scarcely as long as snout, 4 in head; base of tongue without teeth; head scaled to between the nostrils; gill rakers 4 + 14 to 17, rather long, as long as gill fringes. Dorsal and anal spines moderate, the longest dorsal spine 2 in head; the second anal spine 2½ to 3, as long as third spine; dorsal fins considerably connected. Pectorals 1⅓ to 1¼ in head. Color olivaceous, varying to dark green; sides silvery or olivaceous, usually with faint, paler streaks. Length 8 to 14 inches. Atlantic Coast of the United States, from Nova Scotia to South Carolina, ascending streams and frequently landlocked in ponds, the pond specimens much darker in color; one of the most abundant and characteristic fishes of the brackish waters and river mouths of our Atlantic Coast. A very excellent panfish. Specimens from Woods Hole represent the variety called *nigricans*, very dark green in color, scarcely paler below, the body deeper and the spines lower and shorter than in the common White Perch (head 3⅓ in length; depth 2¾; fourth dorsal spine 2⅖ in head; second anal spine 3⅕; A. III, 9); this form occurs landlocked in fresh-water ponds. (*americanus*, American.)

*The River Perch of New York*, Schöpf, Schrift. der Gesells., Nat. Freunde, viii, 159, 1788, New York.

*Perca americana*, Gmelin, Syst. Nat., i, III, 1308, 1788, New York; after Schöpf.

*Perca immaculata*, Walbaum, Artedi Genera Piscium, 330, 1788, New York; after Schöpf.

*Morone rufa*, Mitchill, Rep. Fishes N. Y., 18, 1814, New York.

*Morone pallida*, Mitchill, Rep. Fishes N. Y., 18, 1814, New York.

*Centropomus albus*, Rafinesque, Pricis des Découvertes Somiolog., 1814, 19, Philadelphia.

*Perca mucronata*, Rafinesque, Am. Month. Mag. and Crit. Rev., ii, 204, 1818, Delaware, Schuylkill, and Susquehanna rivers.

*Labrax nigricans*, De Kay, Nat. Hist. N. Y.: Fishes, 12, pl. 50, fig. 160, 1842, Long Island; landlocked form.

*Bodianus rufus*, Mitchill, Trans. Lit. and Phil. Soc. N. Y., i, 420, 1815.

*Labrax mucronatus*, Cuvier & Valenciennes, Hist. Nat. Poiss., ii, 86, pl. 121, 1828.

*Labrax pallidus*, De Kay, Nat. Hist. N. Y.: Fishes, ii, pl. i, fig. 2, 1842.

*Labrax rufus*, De Kay, Nat. Hist. N. Y.: Fishes, 9, pl. 3, fig. 7, 1842; Günther, Cat., i, 65, 1859.

*Labrax americanus*, Holbrook, Ichth. S. C., Ed. 1, 21, pl. 3, fig. 2, 1856.

*Morone americana*, Gill, Ichth. Rep. Capt. Simpson Sur. Great Basin, Utah, 397, 1876; Jordan & Gilbert, Proc. U. S. Nat. Mus., 1878, 380; Jordan & Eigenmann, *l. c.*, 421, 1890; Boulenger, Cat., i, 126.

## 493. LIOPROPOMA,* Gill.

*Liopropoma*, Gill, Proc. Ac. Nat. Sci. Phila., 1862, 236, (*aberrans*).

?*Pikea*, Steindachner, Sitzgber. Ak. Wien, lxxi, 1874, 375, (*lunulata*).

?*Labracopsis*, Steindachner & Döderlein, Denkschr. Ak. Wien, xlvii, 225, 1883, (*japonicus*).

Body elongate, the caudal peduncle robust; mouth moderate, the lower jaw projecting; maxillaries scaly; teeth small, uniform; preopercle entire; opercle with a spine; numerous pores on head. Scales large. Lateral line with a strong upward curve, as in *Anthias*. Dorsal spines moderate, 9 in number, the third highest, the fin deeply notched. Soft dorsal and anal short; caudal short, lunate; pectorals long, falcate. Vertebræ 10 + 14. One species known, from deep water. (λεῖος, smooth; προπῶμα, preopercle.)

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* Dr. Boulenger unites to *Liopropoma* the extralimital genera—*Pikea*, Steindachner and *Labarcopsis*, Steindachner & Döderlein. In these genera there are but 8 dorsal spines, and in *Labarcopsis* the preopercle is serrate. *Pikea* is certainly very close to *Liopropoma*.

### 1533. LIOPROPOMA ABERRANS (Poey).

Head 2⅘; depth 3⅘; D. IX, 12; A. III, 8; scales 45; vertebræ 10+14. Body rather elongate, the back little elevated; the caudal peduncle very thick. Head large, form as in *Epinephelus*. Maxillary extending to below posterior part of eye. Lower jaw longest; teeth small, uniform on jaws, vomer, and palatines. Preopercle entire; opercle with a spine. Eye moderate, 1½ in snout, 4½ in head. Head with numerous conspicuous pores, especially above eye, on preorbital, suborbital, and lower jaw. Lateral line with a strong upward curve running close to spinous dorsal. Dorsal spines moderate, the third longest, 3 in head; the sixth shortest, seventh, eighth, and ninth progressively longer, so that the spinous dorsal is deeply notched; anal spines slender, graduated; caudal short, lunate; pectorals long, falcate, 1⅗ in head; ventrals shorter, 2½ in head, inserted farther forward. Head scaly, including the maxillaries; soft parts of vertical fins with scales. Head rose-color, rest of body orange; the rose-color extending on back and throat, the orange forming a broad band to end of muzzle; cheeks with orange spots; an orange border on the maxillary; vertical fins orange, paired fins rose-color; a yellow post-ocular band. Pyloric cœca 4. Coast of Cuba; known from one specimen, 5 inches long. (Poey.) (*aberrans*, wandering away, from the type of *Perca*.)

*Perca aberrans*, Poey, Memorias, II, 125, 1860, Cuba.
*Liopropoma aberrans*, Poey, Synopsis, 291, 1868; Boulenger, Cat., I, 155.

## 494. CHORISTISTIUM, Gill.

*Chorististium*, Gill, Proc. Ac. Nat. Sci. Phila., 1862, 236, (*rubrum*).

Body rather short and deep, covered with ctenoid scales. Lateral line running high, close to dorsal anteriorly. Mouth large, the lower jaw projecting, the teeth all villiform; maxillary scaly; preopercle entire; gill rakers moderate, slender. Dorsal spines 6, the two fins well separated, the second spine longest; soft dorsal and anal produced backward to a point. Caudal truncate. One species known, from deep water. (*χωριστός*, divided; *ἱστίον*, sail, for dorsal fin.)

### 1534. CHORISTISTIUM RUBRUM (Poey).

Head 3⅕ in total length; depth 4⅕; eye 4 = snout. D. V–I, 12; A. III, 8. Body rather stout, with deep caudal peduncle. Head long, narrow, resembling that of *Sphyræna*. Lower jaw much longer than upper; chin projecting; teeth very small; maxillary reaching posterior border of orbit; jaws with pores; preorbital very narrow, not sheathing the maxillary. Both jaws, vomer, and palatines with villiform teeth; preopercle rounded, with two borders, both entire; opercle with two spines; gill rakers moderate, slender. Scales covering the body, except the extreme end of muzzle, ctenoid; small scales on second dorsal and anal; lateral line running very high anteriorly, forming a high arch, as in *Anthias*. Dorsal fin very short, notched to the base; first dorsal spine nearly as long as second, the others rapidly shortened; second dorsal opposite anal; both fins high and produced backward in a point; second anal spine nearly as long as third; caudal squarely truncate. Color deep red, with 5 reddish longitudinal stripes, the middle one from snout to base of caudal, the others parallel, extending on the head; another streak on the middle line under the throat; a narrow streak of pale orange in each interspace; fins red; a black spot on the point of the dorsal, on that of the anal, and on each angle of caudal; these fins also edged with white. Length 4 inches. Coast of Cuba, in deep water; very rare. Here described from Poey's type in the Museum at Cambridge. (*ruber*, red.)

*Liopropoma rubra*, Poey, Memorias, II, 418, 1861, Havana.
*Chorististium rubrum*, Poey, Synopsis, 291.

## 495. STEREOLEPIS, Ayres.

(Jewfishes.)

*Stereolepis*, Ayres, Proc. Cal. Ac. Sci. 1859, 28, (*gigas*).
*Megaperca*, Hilgendorf, Sitzgber. Ges. Nat. Freunde, Berlin, 1878, 155, (*ischinagi*).

Body oblong, somewhat elevated, little compressed. Head robust, the profile steeply elevated, the forehead broad and flattish. Edges of preopercle and interopercle serrate, becoming nearly entire with age, the interopercle with antrorse spines on its lower border; opercle with two obtuse spines. Crown, cheeks, and opercles scaly; snout, preorbital, and jaws naked. Scales small, not strongly ctenoid, their surface rugose, with radiating striæ. Mouth large, wide, placed low; lower jaw prominent. Maxillary with a well-developed supplemental bone, extending to below the eye. Preorbital wide, only the anterior edge of the maxillary slipping under it. Teeth all villiform, in broad bands on jaws, vomer, and palatines. Branchiostegals 7. Pseudobranchiæ very large. Gill rakers very strong. Dorsal fin with 11 low, stout spines, and 10 soft rays, the last spines very much shorter than the middle ones, and all depressible in a deep groove. Anal fin short, similar to soft dorsal, with 3 low, stout spines; caudal fin broad, nearly truncate; soft dorsal and anal scaly; pectorals moderate; ventrals long, inserted a little before pectorals; caudal truncate or rounded. Vertebræ 26. Pyloric cœca about 7. Size enormous, among the largest of Percoid fishes. This genus contains two species, the gigantic Serranoids known as "Jewfishes," rivaling in size *Polyprion cernium*, *Garrupa nigrita*, and *Promicrops guttatus*. (*στερεός*, firm; *λεπίς*, scale).

### 1535. STEREOLEPIS GIGAS, Ayres.

(California Jewfish.)

Head 3 in length; depth 3. D. XI, 10; A. III, 8; scales 115. Body oblong, somewhat elevated, little compressed; head robust, the profile steeply elevated, the forehead broad and flattish; edges of preopercle and interopercle serrate, becoming nearly entire with age; crown, cheeks, and opercles scaly; snout, preorbital, and jaws naked; scales small, not strongly ctenoid, the surface rugose, with radiating striæ; mouth large, lower jaw prominent; maxillary with a well-developed supplemental bone extending to below the eye; preorbital wide; teeth all villiform, in broad bands on jaws, vomer, and palatines; dorsal spines stout, the last spines very much shorter than the middle ones, and all depressible in a deep groove; anal fin similar to soft dorsal, with 3 low, stout spines; caudal fin broad, nearly truncate; pectorals moderate; ventrals long, reaching vent. Color brownish, with large black blotches, becoming with age nearly uniform greenish black; vertical fins in the young with a conspicuous pale edge; ventrals black. Coast of California from Coronados Island (San Diego) north to the Farallones. A huge fish, rather common about rocks, reaching a weight of 400 to 500 pounds and a length of 5 to 7 feet. (*γίγας*, *gigas*, giant.)

*Stereolepis gigas*, AYRES, Proc. Cal. Ac. Sci., 1859, 28, **Southern California**; JORDAN & GILBERT, Proc. U. S. Nat. Mus., 27, 1880; JORDAN & GILBERT, Synopsis, 531; JORDAN & EIGENMANN, *l. c.*, 344, 1890.

*Stereolepis californicus*, GILL, Proc. Ac. Nat. Sci. Phila., 330, 1863, **California**; substitute for *gigas*, supposed to be preoccupied, but the *Centropristis gigas* of OWEN is *Polyprion oxygeneios.*

? ? *Megaperca ischinagi*,* HILGENDORF, Sitzgb. Ges. Nat. Fr. Berlin, 1878, 156, **Yeddo and Yokohama.**

## 496. POLYPRION, Cuvier.

### (WRECKFISHES.)

*Polyprion* (CUVIER) VALENCIENNES, Mémoires du Muséum, XI, 265, 1824, (*cernium*).
*Hectoria*, CASTELNAU, Proc. Zoöl. Soc. Vict., II, 1873, 1851, (*gigas* = *oxygeneios*).

Body robust, moderately elevated, not much compressed, covered with small, firm, ctenoid scales which extend on the bases of the vertical fins. Lateral line complete, partly concealed under adjacent scales, the tubes covering the whole length of the scale. Mouth large, the lower jaw projecting; maxillary with supplemental bone. Teeth in broad, villiform bands on jaws, vomer, palatines, and tongue; no canine teeth. Head scaly. Preopercle serrate; orbital region with spinous projections; opercle with a strong spine and with a strong, rough, bony longitudinal ridge. Gill membranes separate; gill rakers long, few. Dorsal fin continuous, low, with 11 strong spines and 11 or 12 rays, the spinous portion longest; caudal rounded; anal short, with 3 spines, the third the longest; ventrals large, inserted below, little behind pectoral; caudal rounded or truncate; pectorals short, unsymmetrical, of 18 or 19 rays, the upper longest. Spines of anal and ventrals somewhat serrate on the anterior edge. Vertebræ 13 + 14 = 27. Pyloric cœca about 70. Branchiostegals 7. Posterior processes of premaxillaries not reaching frontals; parietal and supraocular crests not extending between postfrontal processes; supraoccipital crest strong, but not produced forward on cranium. Species inhabiting deep waters in the warm seas, reaching a very great size. The one is confined to the coasts of Southern Europe and neighboring waters; the other

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* Dr. Boulenger is probably in error in placing this Japanese species in the synonymy of *Stereolepis gigas.*

(*Polyprion oxygeneios*) is recorded from Juan Fernandez and about New Zealand. (πολύς, many; πρίων, saw, from the numerous serrations on head and fins.)

### 1536. POLYPRION AMERICANUS (Bloch & Schneider).

(Wreckfish; Stone Bass; Cernier.)

Head 3; depth 2⅔ to 3½. D. XI, 12; A. III, 8. Body robust, moderately elevated; mouth large, the maxillary reaching posterior border of eyes; teeth in villiform bands on jaws, vomer, palatines and tongue; supraocular region, supraclavicle, post-temporal, preopercle, and a ridge on the opercle spinigerous; dorsal fin low, with 11 strong spines; caudal rounded; anal spines short, serrate anteriorly, the third much the longest; ventrals large; pectoral short. Color grayish brown, the caudal edged with white; young clouded with light and dark. This large fish is not uncommon off the coast of Europe in deep waters of 300 fathoms or more, the young only swimming near the surface, especially southward. It is said to live most abundantly about wrecks; hence the common name of wreckfish. It reaches a length of 5 or 6 feet. A single young specimen has been taken in the deep waters of the Gulf Stream by the United States Fish Commission, but there is no other record from America. (Eu.)

? *Amphiprion americanus*, Bloch & Schneider, Syst. Ichth., 205, 1801, Pl. xlvii; (based on a drawing sent by Latham to Schneider representing some fish called in America "*girom;*" called *Amphiprion australis* on pl. 47).

*Scorpæna massiliensis*, Risso, Ichth Nice, 184, 1810, Marseilles.

*Polyprion cernium*, Cuvier, in Valenciennes, Mém. du Museum, xi, 265, Pl. xvii, 1824, France; Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 21, pl. 42, 1829; Günther, Cat., i, 169.

*Holocentrus gulo*, Risso, Europe Méridionale, iii, 367, 1826, Nice.

*Serranus couchii*, Yarrell, British Fishes, Ed. 1, 12, 1836, Great Britain.

*Polyprion oxygenius*, Jordan & Gilbert, Synopsis, 532, 1883, (not *Epinephelus oxygeneios*, Bloch & Schneider, which is the New Zealand species).

*Polyprion americanus*, Jordan, Cat. Fish. N. A., 83, 1885, (after *Amphiprion americanus*, Bloch & Schneider); Boulenger, Cat., i, 148.

*Polyprion cernium*, Jordan & Eigenmann, *l. c.*, 342, 1890.

## 497. GONIOPLECTRUS, Gill.

(Spanish Flags.)

*Gonioplectrus*, Gill, Proc. Ac. Nat. Sci., Phila , 1862, 236, 237, (*hispanum*).

Body short, deep, with very short tail, covered with small scales, the lateral line running high, bent posteriorly. Mouth large; maxillary with a supplemental bone; dentition essentially as in *Epinephelus*; preopercle with a large antrorse hook; opercle with sharp spines; posterior nostril slit-like; gill rakers long and slender. Dorsal spines 8 in number, low and stout; soft dorsal and anal short; anal spines strong; pectoral rounded, its upper rays longest. This well-marked genus contains a single species, allied to *Plectropoma* and *Alphestes*, but with a stronger opercular armature than is found in any other genus. According to Poey, the skull "shows a great affinity with *Hypoplectrus*. Thus it is rounded above, the supra-occipital crest is below the level of the frontals; the other crests are low." (*γωνία*, angle; *πλῆκτρον*, spur.)

### 1537. GONIOPLECTRUS HISPANUS (Cuvier & Valenciennes).

("SPANISH FLAG"; OUATILIBI ESPAGNOL; BIAJAIBA DE LO ALTO.)

Head 2½ in length; depth 2⅖. D. VIII, 13; A. III, 7; scales 70. Body short and deep, with very short, deep tail; interorbital region narrow, the bones rugose: snout 3⅖ in head; maxillary reaching middle of orbit, 2 in head, naked, its supplemental bone well developed; preorbital narrow; lower jaw projecting, teeth very small, in narrow, villiform bands, the depressible teeth very few; a stout canine on each side, in front of each jaw, and 1 or 2 similar canines in middle of side of lower jaw; eye 4⅛ in head (exclusive of opercular spine); preopercle finely serrate, with a single very large antrorse hook at its angle; opercle ending in 4 spines, the second of which is long, straight, compressed and knife-shaped, as long as eye; nostrils small, round, separated, the posterior the larger; suborbital serrate on its edge; gill rakers rather long and slender, x + 15; scales small, firm, and rough; lateral line arched, running high, close to middle of spinous dorsal and then bent abruptly downward; dorsal spines low and stout, the fin notched; soft dorsal short and rather high; longest dorsal spine 3 in head; second anal spine 2⅔, very strong, longer than third, the soft rays high and rather short, scaly; pectorals moderate, unsymmetrically rounded at tip, the upper rays longest, longer than ventrals, 1⅛ in head; caudal truncate, its peduncle as deep as long. Color rose-colored, with yellow stripes along head and back; top of head with orange spots; a pale bar before vent; caudal fins sometimes with dark spots; fins otherwise plain. West Indies; not common; the specimens here described from Cuba, being sent by Poey to the Museum at Cambridge. (*hispanus*, Spanish, its splendid colors resembling those of the Spanish flag.)

*Plectropoma hispanum*, CUVIER & VALENCIENNES Hist. Nat. Poiss., II, 396, 1828, Martinique; POEY, Memorias Cuba, I, 72 pl. 4, fig. 1, 1851; GÜNTHER, Cat., I, 165, 1859.

*Gonioplectrus hispanus*, POEY, Synopsis, 289, 1868; JORDAN & EIGENMANN, *l. c.*, 346, 1890; BOULENGER, Cat., I, 159.

## 498. PETROMETOPON, Gill.

(ENJAMBRES.)

*Petrometopon*, GILL, Proc. Ac. Nat. Sci. Phila., 1865, 105, ("*guttatus*," POEY = *cruentatus*).

Frontal bones with an anterior groove or excavation for the reception of the posterior processes of the premaxillaries, without processes on the upper surface; a curved or angular ridge across the posterior portion of the frontals in front of the supraoccipital, connecting the parietal crests; supraoccipital and parietal crests not produced forward. Dorsal spines 9; anal rays mostly III, 8; scales ctenoid; otherwise essentially as in *Epinephelus*. Species rather few, mostly of small size, distinguished from *Bodianus* chiefly by the peculiarities of the frontal bones, the above account being taken from Boulenger, Cat., I, 175. (πέτρος, stone; μετωπον,[*] forehead.)

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[*] "Distinguished by the petrous-like convexity between the supraorbital grooves and its triangular sinus behind, into the angles on each side of which the lateral crests terminate; the crests are parallel and the surface between flat or slightly convex."—*Gill.*

*a.* Lower jaw strongly projecting; opercular flap pointed; body with 9 or 10 dark cross bands; sides of head and jaws with many round bluish or yellowish spots; a large jet-black spot behind eye; vertical fins edged with blue; preopercle very finely serrulate, its angle not salient; scales rather large (about 80); second anal spine longest; caudal much rounded; ventrals not reaching vent. PANAMENSIS, 1538.

*aa.* Lower jaw not strongly projecting; opercular flap very obtuse; body without cross bands; body, head, and fins more or less covered with scarlet or orange spots; about 4 round, inky spots along base of dorsal; lower jaw not strongly projecting; caudal fin much rounded; scales rather large, ctenoid (about 80); ventrals not reaching vent. CRUENTATUS, 1539.

### 1538. PETROMETOPON PANAMENSIS (Steindachner).

Head 3; depth 3; eye 6 in head. D. IX, 14; A. III, 8; scales 77, pores 53. Body rather elongate, compressed. Head pointed, the lower jaw much projecting; maxillary scaleless; eye broader than interorbital space; two small canines in each jaw; angle of preopercle rounded, its edge beset with very fine teeth; anterior profile of head steep and rather straight; dorsal spines moderate, subequal, the longest scarcely ⅓ head; second and third anal spines about equal; soft dorsal and anal high, much rounded; caudal much rounded; pectoral rather long; scales strongly ctenoid. Color, dark brownish violet; sides with 9 or 10 dark cross bands; sides of head and jaws with many round bluish-yellow spots, those on lips smaller and clear blue; a large jet-black spot behind eye; vertical fins edged with blue; fins unspotted. Panama. (Steindachner.) On rocky coral reefs; rare; the characters of the skull not described by Steindachner, the only naturalist who has seen the species.

*Serranus panamensis*, Steindachner, Ichth. Beiträge, iv, 1, 1871, with plate, Panama.
*Bodianus panamensis*, Jordan & Eigenmann, *l. c.*, 378, 1890.
*Enneacentrus panamensis*, Jordan & Swain, *l. c.*, 398.
*Epinephelus panamensis*, Boulenger, Cat., i, 177.

### 1539. PETROMETOPON CRUENTATUS (Lacépède).

(Enjambre; Coney; Red Hind.)

Head 2½; depth 2⅚; eye 5 in head. D. IX, 14 or 15; A. III, 8; scales 8–85 to 95–30, pores 50 to 55. Body oblong, rather deep and compressed, its width 2¼ in greatest depth. Head moderate, a little acute anteriorly, the profile nearly straight from snout to nape, where it is rather convex. Mouth rather large, the maxillary extending somewhat beyond eye, its length 1⅞ in head. Lower jaw not strongly projecting. Teeth in narrow bands, the depressible teeth of the inner series very long and slender, longer than in any other of our species, those of the lower jaw and front of upper especially enlarged, longer than the small, subequal canines; interorbital space narrow, with a median depression, its width 7 in head. Preopercle convex, very weakly serrate, its posterior angle obliquely subtruncate, without salient angle or distinct emargination. Opercle with 3 distinct spines. Nostrils small, subequal. Gill rakers slender, x + 9 to 11 besides rudiments, the longest as long as gill fringes. Scales rather large, mostly strongly ctenoid. Dorsal spines rather slender and pungent, the fourth and fifth spines highest, 3⅖ in head, the outline of the fin gently arched; caudal very convex, its middle rays 1⅗ in head, their length 1⅖ times that of the outer rays; anal rounded, its longest ray half head; second anal spine a little stronger than third and slightly longer, 2⅝ in head; pectorals long, reaching much past tip of ventrals, 1½ in head; ventrals short, not reaching vent. In the typical form (*cruentatus*), from rather deep water and among rocks, the ground hue in life is a livid reddish gray, a little paler below, and the spots are vermilion, usually darker posteriorly; the spots are larger especially anteriorly. In spirits the vermilion spots become light gray, except posteriorly, where they are brown; those on the head remain very distinct, those above never disappearing. Length about a foot. West Indian fauna; Brazil to Florida Keys; a beautiful fish; very common on the coast of Cuba; a food-fish of some importance. (*cruentatus*, dyed with blood.)

*Jurvucapeba* or *Itaiara*, MARCGRAVE, Hist. Brasil, 146, 1648, Brazil (doubtful).
*Perca guttata**, BLOCH, Ichthyol., 312, 1792, Martinique (description and figures from a drawing by PLUMIER); not *Perca guttata* of LINNÆUS, which is *Promicrops guttatus.*
*Sparus cruentatus*, LACÉPÈDE, Hist. Nat. Poiss., IV, 157, pl. 4, fig. 1, 1803, Martinique (on a copy of Plumier's drawing).
*Saranus apiarius*, POEY, Memorias, II, 143, 1860, Havana.
*Serranus coronatus*, GÜNTHER, Cat., I, 124, 1859.
*Petrometopon apiarius*, POEY, Synopsis, 1868, 288.
*Enneacentrus guttatus*,* JORDAN & SWAIN, *l. c.*, 399, 1884.
*Bodianus cruentatus*, JORDAN & EIGENMANN, *l. c.*, 378, 1890.
*Epinephelus guttatus*, BOULENGER, Cat., I, 176.

Represented in shallow waters by the form or variety

### 1539a. PETROMETOPON CRUENTATUS CORONATUS (Cuvier & Valenciennes).

(BROWN HIND; PETITE NÈGRE.)

In life, whitish or dusky olive, somewhat translucent, the head decidedly greenish; spots everywhere, all bright orange red, darker in the center, those on the edges of the vertical fins darker maroon or cherry color; four larger spots along base of dorsal, inky black, irregular, the third largest, the fourth smallest; a very small one on each side of shoulder. Eyes green above, with red specks, iris yellow; fins rather bluish; tips of ventrals dusky, tips of vertical fins appearing so from the darker color of the spots. In spirits, the bright spots become brown or fade into the ground color; those on the head mostly disappearing. In other respects like the preceding, its colors duller. West Indies, north to Key West; generally common. (*coronatus*, crowned.)

*Serranus coronatus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., II, 371, 1828, Martinique.
*Serranus coronatus* var. *nigriculus*, GÜNTHER, Cat., I, 124, 1859.
*Petrometopon guttatus*, POEY, Synopsis, 288, 1868.
*Epinephelus guttatus*, JORDAN, Proc. U. S. Nat. Mus., 1884, 125.
*Enneacentrus guttatus coronatus*, JORDAN & SWAIN, *l. c.*, 1884, 398.

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* As this species is in no wise concerned in forming the *Perca guttata* of Linnæus, the specific name *guttatus* should not be used for it. The *Bodianus guttatus* of Bloch (*Serranus myriaster* Cuvier & Valenciennes) is an East Indian species, referable to *Bodianus* as here restricted.

## 499. BODIANUS, Bloch.

### (JACOB EVERTZENS.*)

*Bodianus*,† BLOCH, Ichthyologia, 1790, (*guttatus*, *bodianus*, etc., species with entire preopercle and spine on opercle).

*Cephalopholis*, BLOCH & SCHNEIDER, Syst. Ichth., 311, 1801, (*argus* = *Bodianus guttatus*, BLOCH,= *Serranus myriaster* CUVIER & VALENCIENNES).

*Bodianus*, CUVIER, Règne Animal, Ed. 1, II, 276, 1817; GILL, Proc. Ac. Nat. Sci. Phila., 1862, 237 (restriction to *guttatus*, etc.)

*Uriphæton*,‡ SWAINSON, Nat. Hist. Classn. Fishes, II, 202, 1839, (*phæton*).

*Enneacentrus*, GILL, Proc Ac. Nat. Sci. Phila., 1865, 105, (*ouatalibi* = *fulvus*, *Bodianus* being transferred to *Bodianus bodianus*, BLOCH, = *Harpe rufa*).

*Menephorus*, POEY, Ann. Lyc. Nat. Hist. N. Y., X, 1869, 50, (*dubius*).

*Enneistus*, JORDAN & EVERMANN, new subgenus, (*acanthistius*).

This genus is close to *Epinephelus*, from which it is separated mainly by the presence of 9 spines in the dorsal fin instead of 11. In character of cranium the two genera differ little, the skull above having its bones thin and smooth, the angular ridge on the posterior part of the frontals being wanting, the parietal and supraoccipital crests not extending on the frontals. Species rather numerous in warm seas, of small size and bright color. (*Bodiano* or *Pudiano*, Portuguese name of the larger Labroid fishes in Brazil, the name used for *Harpe rufa*, which Bloch referred to this genus. The word is from *pudor*, modesty, and is cognate with *Donzella*, *Señorita*, and similar terms applied to the same fishes, in opposition to *Old Wife*, *Vieja*, etc., given to the larger and plainly-colored species.)

BODIANUS:

*a.* Scales ctenoid; none of the dorsal spines elevated.
  *b.* Caudal fin not lunate; head and body with few or many small, blue, dark-edged spots.
    *c.* Caudal fin rounded, the middle rays longest; snout with 1 or 2 blue stripes; back of tail without conspicuous black blotch; scales small; lateral line about 115. TÆNIOPS, 1540.
    *cc.* Caudal fin truncate, the middle and outer rays about equal; snout without stripes; back of tail with 2 black spots; lower jaw with a black spot at tip; scales moderate; lateral line about 90.
      *d.* Ground color lemon-yellow; blue spots few. FULVUS, 1541.
      *dd.* Ground color bright scarlet. RUBER, 1541*a*.
      *ddd.* Ground color brown. PUNCTATUS, 1541*b*.

MENEPHORUS (μήνη, moon; φορεω, to bear):

  *bb.* Caudal fin lunate, with prominent angles; body covered with blue spots.
    *e.* Body rather deep; preopercle evenly convex, without salient angle; mouth small, the lower jaw much projecting; gill rakers slender, long, about x + 20; color carmine red, the head, back, and sides more or less covered with blue, dark-edged points; caudal tips black; some dark spots on maxillary and about eye; no black blotch on caudal peduncle or on tip of lower jaw. DUBIUS, 1542.
    *ee.* Body more slender, the depth 4 in total length; eye 5½ in head. PUNCTIFERUS, 1543.

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* According to Bloch, Jacob Evertzen was a noted Dutch pilot in the middle of the last century. From his pock-marked face, his fellow sailors gave to these dark-spotted and freckled fishes (especially to *Bodianus guttatus*, the type of the genus) the name of Jacob Evertzen.

† *Bodianus* of Bloch is an artificial group, resting on characters valueless or erroneous. It was limited by Cuvier, in 1817, to species allied to *Epinephelus*; by Gill, 1862, to 9-spined species of this group; and by Jordan & Gilbert, 1883, to the limits here assigned, *Bodianus guttatus*, Bloch (= *argus*), an East Indian species, being recognized as the type.

‡ The generic name *Uriphæton* was given to a specimen, "*Serranus phæton*" Cuvier & Valenciennes, of some species of *Bodianus*, probably *Bodianus nigripinnis*, according to Boulenger, in the caudal fin of which the caudal filament of *Fistularia* had been inserted.

Enneistus (ἐννέα, nine; ἱστός, mast):

*aa.* Scales not ctenoid; third dorsal spine elevated; maxillary naked.

*f.* Color red; a black streak on cheeks; fins all blackish on distal half. ACANTHISTIUS, 1544.

### 1540. BODIANUS TÆNIOPS (Cuvier & Valenciennes).

Head 2⁴⁄₅ to 3; depth 3 to 3⅕. D. IX, 15; A. III, 9 (rarely 10); scales 10 to 12, 125 to 130–42 to 48, pores 75 to 82. Teeth forming rather broad bands, in 3 or 4 series on the sides of the mandible; canines strong. Snout 1¼ to 1½ diameter of eye, which is contained 5 to 6 times in length of head; interorbital width 6 to 7 times in length of head; lower jaw projecting; maxillary extending to below posterior border of eye or beyond, the width of its distal extremity equal to or a little less than diameter of eye; preopercle very finely serrated, the serræ scarcely enlarged at the angle, which is rounded; middle opercular spine nearer lower than upper, lower not extending so far back as upper; opercular flap obtusely pointed, its upper border strongly curved; head covered with cycloid scales; snout and maxillary entirely or partially scaly. Gill rakers 10 or 11, and 6 to 8 rudiments on lower part of anterior arch, the longest longer than gill fringes. Dorsal originating above base of pectoral; spines increasing in length to the third, which is about ⅓ length of head and shorter than posterior soft rays; soft dorsal rounded; pectoral ⅔ to ¾ length of head; ventral shorter, reaching anus or not quite so far; second and third anal spines equal, as long as or a little shorter than longest dorsal spine and much shorter than soft rays; caudal rounded. Scales strongly ciliated. Dark brown (or red) all over, with small, blue, black-edged spots; a blue horizontal streak below the eye; soft dorsal, anal, and caudal edged with blue. Length 1 foot. (Boulenger.) West coast of Africa, and adjacent islands; very common; said by Steindachner to stray to the coast of Florida and the Bahamas; not obtained by any American collector. (ταινία, band; ὤψ, face.)

*Serranus tæniops*, Cuvier & Valenciennes, Hist. Nat. Poiss., II, 370, 1828, Cape Verde; Günther, Cat., I, 121, 1859; Steindachner, Fische Afrikas, 1881, 4, pl. 1 ("very common on the coast of Senegambia to the Cape Verde Islands and Guinea; rare on the coasts of the Bahama Islands to Florida.")

*Bodianus tæniops*, Jordan & Gilbert, Synopsis, 919, 1883; Jordan & Eigenmann, *l. c.*, 379, 1890.

*Enneacentrus tæniops*, Jordan & Swain, *l. c.*, 402, 1884.

*Epinephelus tæniops*, Boulenger, Cat., I, 186.

### 1541. BODIANUS FULVUS (Linnæus).

(Guatívere; Nigger-fish; Yellow fish; Butter-fish; Guatívere Amarilla.)

Head 2⅜; depth 3; eye large, 5 in head. D. IX, 14 to 16; A. III, 8 or 9; scales 9-90 to 110–33, pores 53 to 65. Body oblong, moderately compressed, its greatest width 2⅓ in depth. Head rather pointed anteriorly, the profile forming an even curve from snout to base of dorsal. Mouth moderate, the maxillary extending somewhat beyond eye, its length 2 in head. Lower jaw strongly projecting. Teeth in narrow bands, rather large, the depressible teeth smaller than in *Petrometopon cruentatus*; canines rather small, subequal; interorbital space narrow, flattish, with a median depression, its width 7 in head. Preopercle with weak serrations, its outline convex, with a slight and shallow emargination, its angle not salient. Opercle with 3 distinct spines. Nostrils small, subequal. Gill rakers slender, x + 17 or 18, the longest as long as gill fringes. Scales rather large, mostly strongly ctenoid. Dorsal spines slender, pungent, the fourth and fifth highest; the outline of the fin above nearly straight. Caudal truncate, its angles slightly rounded, its longest (middle) rays $1\frac{5}{7}$ in head, scarcely longer than the outer rays; anal high, rounded, its longest rays 2 in head; second anal spine stronger and rather longer than third, $2\frac{2}{3}$ in head; pectoral long, reaching much past tips of ventrals, $1\frac{1}{2}$ in head; ventral short, not reaching vent. Color in the typical form (*fulvus*): In life, lemon yellow, being somewhat orange red on the back; two black spots on back of tail; a few sky-blue spots on body anteriorly, and on head with darker margins; a few violet spots about eye; fins colored like body; head, pectorals and dorsal a little redder than rest of fish. Edge of spinous dorsal blackish. Color in spirits, olivaceous yellow; other color variations indicated below. Length about a foot. West Indies; ranging from Bermuda and Florida Keys to Bahia; everywhere very common, the brown and the red forms most so, the yellow or typical variety scarce in the markets of Cuba and not yet recorded from Florida. This is probably confined to water still deeper than that inhabited by the red variety. (*fulvus*, tawny in color.)

*Turdus cauda convexa* (the Yellow Fish), CATESBY, Nat. Hist. Carol., pl. x, fig. 2, 1743, Bahamas.
*Labrus fulvus*, LINNÆUS, Syst. Nat., Ed. x, 1758, 287, Bahamas; after CATESBY.
*Guatívere amarilla*, PARRA, Descr. Dif. Piezas, Hist. Nat. Cuba, 1787, lam. v, fig. 2, Cuba.
*Holocentrus auratus*, BLOCH, Ichthyol., VII, 57, pl. 236, 1792, East Indies.
*Bodianus guatívere*, BLOCH & SCHNEIDER, Syst. Ichth., 1801, 336; based on PARRA'S figures.
*Serranus auratus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., II, 364, 1828.
*Serranus guatívere*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., II, 383, 1828, on PARRA'S second figure; POEY, Repertorio, I, 203.
*Enneacentrus fulvus*, JORDAN & SWAIN, *l. c.*, 402, 1884,
*Bodianus fulvus*, JORDAN & EIGENMANN, *l. c.*, 379.

Represented at moderate depths, especially in the West Indies, by the scarlet form or variety

### 1541a. BODIANUS FULVUS RUBER (Bloch & Schneider).

(RED GUATÍVERE; OUATILIBI.)

Color in life, vivid scarlet; spots on head nearly black; others light blue, with a purplish border; two black spots on lower jaw and two on back of tail; caudal paler than body, with a few scattering dark points; ventrals and anal edged with dusky. Pectorals paler than dorsal. In spirits this fish becomes pale, almost cream color; spots on head dark, the others brown, with grayish margins. West Indies, etc.; very common. (*ruber*, red.)

*Carauna*, MARCGRAVE, Hist. Brasil, 1648, 147, Brazil.
*Guatívere*, PARRA, Descr. Dif. Piezas, Hist. Nat., 1787, lam. v, fig. 1, Cuba.
*Perca punctata*, BLOCH, Ichth., 314, 1792, Martinique; on a figure by PLUMIER.

*Gymnocephalus ruber*, Bloch & Schneider, Syst. Ichth., 346, pl. 67, 1801, on *Carauna* of Marcgrave; not *Epinephelus ruber*, Bloch.

*Serranus ouatalibi*, Cuvier & Valenciennes, Hist. Nat. Poiss., ii, 381, 1828, Havana; Günther, Cat. i, 1859, 120; Poey, Repertorio, i, 202, 1867.

*Serranus carauna*, Cuvier & Valenciennes, Hist. Nat. Poiss., ii, 384, 1828, Brazil.

*Enneacentrus fulvus outalibi*, Jordan & Swain, *l. c.*, 402.

*Bodianus fulvus ruber*, Jordan & Eigenmann, *l. c.*, 379.

Represented along the shores from Southern Florida to the West Indies by the brown form or variety

### 1541b. BODIANUS FULVUS PUNCTATUS (Linnæus).

(Nigger-fish; Negro-fish; Black Guatívere.)

Color in life, blackish olive; spots everywhere on sides and head, dark blue with light-blue centers; dorsal fin dusky olive, edged with darker, a few spots on its base; the soft dorsal margined with whitish. Caudal dusky olive; anal and ventrals violaceous black; pectorals olivaceous; the spots in spirits become brown, with gray centers. West Indies, etc.; everywhere common. (*punctatus*, dotted.)

*Perca marina puncticulata* (the Negro-fish), Catesby, Hist. Carolina, etc., pl. 7, 1843, Bahamas.

*Perca punctata*, Linnæus, Syst. Nat., x, 1758, 291, Bahamas; based on Catesby.

*Perca punctulata*, Gmelin, Syst. Nat., 1315, 1788, Bahamas; after Catesby.

*Enneacentrus punctatus*, Poey, Synopsis, 288, 1868.

*Bodianus punctatus*, Jordan & Gilbert, Synopsis, 919, 1883.

*Bodianus fulvus punctatus*, Jordan & Eigenmann, *l. c.*, 380.

*Epinephelus punctatus*, Boulenger, Cat., i, 184.

### Subgenus MENEPHORUS, Poey.

### 1542. BODIANUS DUBIUS (Poey).

Head 3⅕; depth 2⅚; eye moderate, 4½ in head, as long as snout. D. IX, 11 + (the fin having been injured in youth); A. III, 9; scales 96. Body rather deep and compressed, formed much as in *Bodianus fulvus*; head anteriorly pointed, the profile forming a slight, even curve. Mouth small; maxillary extending to posterior edge of pupil, 2⅕ in head; lower jaw much projecting; teeth moderate, the anterior canines in both jaws rather strong. Interorbital space narrow. Preopercle finely serrate, its outline evenly convex. Gill rakers slender and long, x + 20. Scales moderate, strongly ctenoid. Caudal fin lunate, its angles pointed, the inner rays 2⅓ in head, the outer 1⅗. Dorsal spines low, stiff, the longest 3 in head; outline of the fin not notched; anal fin high and rounded, its longest rays 2⅓ in head; second anal spine stronger than third, but scarcely longer, 3¾ in head; pectoral long, reaching past tips of ventrals, 1⅙ in head. Color much as in *Bodianus fulvus ruber*, bright red; head, back, and sides covered with blue points, which are edged with blackish; dorsal edged with dusky; caudal tips black above and below; maxillary with a row of dark spots; some dark spots about eye. Length 9 inches. Cuba; 3 specimens known; the one above described in the Museum at Cambridge, probably sent by Poey. A well-marked species.

possibly the type of a valid genus. (*dubius*, doubtful; the author being in doubt as to whether the species belongs to *Serranus*.)

*Serranus dubius*, Poey, Memorias, II, 142, 1860, Cuba.
*Menephorus dubius*, Poey, Ann. Lyc. Nat. Hist. N. Y., x, 1869, 50.
*Bodianus dubius*, Jordan & Eigenmann, *l. c.*, 380.

### 1543. BODIANUS PUNCTIFERUS (Poey).

Very similar to *Bodianus dubius*, differing in the more slender body; the depth 4 in total length; eye $5\frac{1}{2}$ in head, $1\frac{1}{3}$ in snout. Red, the blue spots not covering the whole body, those on the head blue and very small; those on the body forming oblique series of dashes, rather linear than rounded; fins 1-spotted. (Poey.) Cuba. Known from one specimen, 10 inches long, probably a color variation of *Bodianus dubius*. (*punctum*, point; *fero*, I bear.)

*Menephorus punctiferus*, Poey, Enumeratio, 21, 1875, Havana.

## Subgenus ENNEISTUS,* Jordan & Evermann.

### 1544. BODIANUS ACANTHISTIUS (Gilbert).

Head $2\frac{2}{5}$; depth $2\frac{3}{7}$; eye large, equaling length of snout, 5 in length of head; interorbital space narrow, convex, $6\frac{1}{5}$ in head. D. IX, 17; A. III, 9; scales 75, 56 pores. Mouth oblique, with mandible strongly projecting, the mandibular canines shutting outside of premaxillaries in closed mouth; maxillary reaching vertical from behind pupil, its length half that of head. Teeth in sides of mandible in 2 perfectly defined series, separated by a narrow groove-like interval; outer teeth nearly erect and rigid, the inner series directed obliquely inward and very slightly movable (not strictly depressible); a patch of smaller movable teeth at symphysis, with the customary pair of canines in front of them; premaxillaries with an outer series of strong teeth, terminating anteriorly in the double pair of enlarged canines; behind this series a wide band of minute villiform teeth, only slightly movable; wide bands of similar villiform teeth on vomer and palatines, the vomerine patch without backward prolongation along median line; tongue smooth; nostrils close together, the posterior round and much the larger, the anterior with a flap. Preopercle minutely serrulate on hinder margin, which is convexly rounded; a shallow notch above the angle, which is provided with 2 or 3 irregular lobes, coarsely toothed; lower margin smooth, entire. Gill rakers long and strong, 17 below angle, the anterior short; opercle with 3 flat spinous points. Scales with entire edges, those on opercles and on middle of sides the largest, smaller above lateral line and along ventral outline, becoming much reduced on breast and head (except opercles). Mandible with a few embedded scales, maxillary and premaxillary wholly naked; top and sides of head wholly scaled, including both limbs of preopercle and

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*This subgenus seems close to *Bodianus*, from which it differs in its smooth scales, naked maxillary, and elevated spinous dorsal, which is deeply notched as in *Paralabrax*. The character of the cranium has not been indicated in the single known species, but Dr. Boulenger is probably right in placing it with the group here called *Bodianus*.

the opercular membrane. First dorsal spine very short, the third the highest, half length of head, the fourth but little shorter; in the type specimen the fifth and sixth rapidly shortened, while the seventh, eighth, and ninth are again lengthened, thus forming a decided notch in the course of the spinous dorsal; spines all with pungent tips; dorsal membranes from third to sixth spines very deeply incised, that between third and fourth joining latter on the basal $\frac{2}{5}$ of its length; soft dorsal and anal pointed, not falcate, the outline behind angle straight; anal higher than the dorsal, but shorter than the spinous dorsal; caudal rounded, $1\frac{2}{5}$ in the head; pectorals long, reaching beyond the ventrals, and nearly to front of anal; first anal spine concealed in our single specimen, probably mutilated, the second stronger but much shorter than the third, which is contained $4\frac{1}{4}$ in the length of the head. Color of head and body uniform, probably red in life; a black streak on cheeks, following hinder edge of maxillary: fins all blackish on distal half; basal part of fins scaly. A single specimen, 16 inches long, from *Albatross* Station 3017, in 58 fathoms, near Cape Lobos, on the eastern shore of the Gulf of California. This peculiar species is characterized by its convex caudal, plain coloration (varied only by a black streak behind maxillary), its comparatively large, smooth scales, the naked maxillary, and the very high spinous dorsal with its deeply incised membranes. Gulf of California; one specimen known. (*ἄκανθα*, spine; *ἱστίον*, sail.) (Gilbert.)

*Bodianus acanthistius*, GILBERT, Proc. U. S. Nat. Mus., 1891, 552, Cape Labos, on the eastern shore of Gulf of California. (Type, No. 46940. Coll. Albatross.)

## 500. EPINEPHELUS, Bloch.

### (GROUPERS.)

*Epinephelus*, BLOCH, Ichthyologia, 1793, (after, *marginalis*, *brunneus*, *merra*, *ruber*, etc., restricted to *marginalis* by authors).

*Cerna*, BONAPARTE, Introduzione alla Classe Pesci, Fauna Italica, tome III, pt. 1, 1833, (*gigas* = *guaza*).

*Cynichthys*, SWAINSON, Nat. Hist. Classn. Fishes, II, 201, 1839, (*flavo-purpuratus*).

*Cromileptes*, SWAINSON, Nat. Hist. Classn. Fishes, II, 201, 1839, (*gigas*, etc.).

*Hyporthodus*, GILL, Proc. Ac. Nat. Sci. Phila., 1861, 237, (*flavicauda* = *niveatus*).

*Schistorus*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 237, (*mystacinus*).

*Labroperca*, GILL, Proc. Ac. Nat. Sci. Phila., 1863, 80, (*labriformis*).

*Merus*, POEY, Ann. Lyc. Nat. Hist. N. Y., X. p. 39, 1871, (*gigas*).

*Priacanthichthys*, DAY, Proc. Zoöl. Soc. London, 1868, 193, (*maderaspatensis*, young).

*Cerna*, DODERLEIN, Revista delle Specie del genere *Epinephelus* o *Cerna*, 1873, (*gigas*).

*Homalogrystes*, ALLEYNE & MACLEAY, Proc. Linn. Soc. New South Wales, I, 1876, 268, pl. VI, fig. 3, (*güntheri*).

*Hyposerranus*, KLUNZINGER, Fische des Rothen Meeres, 3, 1884, (*morrhua*).

Body stout, compressed, covered with small, ctenoid scales, which are often somewhat embedded in the skin; scales of the lateral line triangular, cycloid; soft parts of the vertical fins generally more or less scaly. Cranium narrow above. Parietal crests not produced on frontals which are without transverse ridge posteriorly; frontals with a process or knob on each side behind interorbital area; premaxillary processes fitting into a notch or cavity on the anterior end of the frontals. Preopercle moderately serrate behind, its lower limb entire, without distinct antrorse spine; opercle with two strong spines. Nostrils well separated. Mouth large; maxillary large, with a well-developed supplemental bone, its surface usually with small scales. Canine teeth few, large in the front of the jaws; enlarged teeth of the inner series of each jaw depressible. Gill rakers short and rather few. Dorsal spines usually 11, rarely 10, not filamentous, the last ones somewhat shorter than the middle ones. Anal spines 3, the second usually the larger; the number of soft rays 7 to 9. Caudal fin rounded or lunate. Pyloric cœca few (usually 10–20). Pectorals rounded, shortish, nearly symmetrical, of 15 to 20 rays. Ventrals moderate, inserted below pectorals, close together, each with a strong spine. Species very numerous, most of them of large size, abounding in all the tropical seas, where they are valuable food-fishes. This is the largest and most important genus of the *Serranidæ*, and its species are most widely distributed. (*ἐπινέφελος*, clouded over, in allusion to the membrane supposed to cover the eye in the typical species.)

I. **Schistorus** (σχιστός, split; ὄρος, for *pylorus*): Nostrils unequal, the posterior much the larger, 3 times diameter of anterior; preopercle with 2 or 3 small irregular teeth below its angle; pyloric cœca in increased number; head large.

  *a.* Second and third anal spines about equal in length; color brownish, with about 8 darker cross bands; dark bands radiating from eye; a dark mustache above maxillary; a dark blotch on back of caudal peduncle. MYSTACINUS, 1545.

II. **Epinephelus**: Nostrils subequal, the posterior scarcely larger than anterior; pyloric cœca in moderate number.

  *a.* Second dorsal spine short, lower than third or fourth, the fin not much notched; caudal rounded more or less; lower opercular spine inserted farther back than upper. Lateral teeth* of lower jaw in more than 2 rows, at least in the adult. Interorbital space of moderate width, its breadth more than half diameter of eye and 7 to 10 times in length of head.

    *b.* Dorsal spines 10; body with faint, dark cross shades and many round, dark orange spots, these extending on the fins; vertical fins not edged with black; preopercle without salient angle; maxillary naked; lower jaw strongly projecting (in all respects except the number of spines almost identical with *E. adscensionis*). ANALOGUS, 1546.

    *bb.* Dorsal spines 11; preopercle without distinct spinules on its lower limb.

      *c.* Maxillary naked.

        *d.* Lower jaw strongly projecting.

          *e.* Body and head covered with red or orange spots (dusky in spirits and always darker than the ground color); vertical fins without dark edge, their bases spotted like the body; body with large pale spots besides the orange spots; young with large black blotches at base of dorsal; angle of preopercle not salient; form robust. ADSCENSIONIS, 1547.

          *ee.* Body and head reddish brown, the adult nearly plain, the young with darker spots; vertical fins broadly edged with dark brown. Body robust, the depth 3 in length. D. XI, 15 or 16. Caudal fin convex behind; maxillary naked; dorsal spines low, subequal; interorbital moderate, 6½ in head; preopercle with strong teeth at its angle, the lower limb entire. GUAZA, 1548.

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* Lateral teeth of lower jaw in two rows only in the group or subgenus *Hyposerranus*, Klunzinger.

*dd.* Lower jaw not prominent. Preopercle without salient angle, the serræ at the angle scarcely enlarged; caudal fin rounded; scales of body smoothish; lower jaw not prominent; eye not surrounded by dark points; body without traces of longitudinal darker stripes; caudal peduncle with a large, quadrate black blotch above (sometimes obsolete in young or in very old examples); color (in spirits) dark brown, with scattered roundish blotches of pale bluish, these most distinct on breast and lower parts of head; fins pale, spotted like the body, their edges darker; young with large round, whitish spots, regularly arranged. LABRIFORMIS, 1549.

*cc.* Maxillary more or less scaly.

*f.* Preopercle with a more or less distinct salient angle, which is armed with larger teeth (these teeth occasionally undeveloped in *E. striatus*, which species may be known by the presence of black points around the eyes).

*g.* Body without orange or dark-brown spots, the spots (if any) brownish or pearly, diffuse or irregular; vertical fins without broad black margin.

*h.* Caudal peduncle without black, saddle-like blotch above. Caudal fin truncate or emarginate when spread open, not convex behind; maxillary usually more or less scaly; vertical fins without broad edging of black; dorsal fin, or a part of it, distinctly edged with bright yellow; color of body uniform reddish brown, a clear blue streak from eye to angle of preorbital; a faint dark mustache; no black spots anywhere; whole dorsal with a bright yellow edging; anal and caudal without pale edging; caudal slightly lunate; maxillary scaly; dorsal rays XI, 14; lower jaw strongly projecting (as in *Epinephelus niveatus*, with which this species seems to agree very closely in all respects except the color). FLAVOLIMBATUS, 1550.

*hh.* Caudal peduncle with a large quadrate saddle-like black blotch above (sometimes wanting in *E. niveatus*, especially in the young).

*i.* Eye not surrounded by dark points; sides brown, marked with large blotches of steel blue, these more or less regularly arranged and not distinct on the breast; no dark cross bars; lower jaw strongly projecting; caudal fin subtruncate, its angles rather acute; pyloric cæca rather numerous. NIVEATUS, 1551.

*ii.* Eye surrounded by conspicuous dark-brown points; body with irregular dark cross bars; angle of preopercle little salient; third dorsal spine highest, 2½ in head; scales moderate, about 100; caudal rounded; lower jaw little projecting; vertical fins in life broadly edged with yellow. STRIATUS, 1552.

*gg.* Body covered with small dark orange or brown spots; lower jaw not prominent; interorbital space very narrow, not half diameter of eye. Vertical fins broadly edged with blue black, their bases unspotted; body without pale spots, the orange spots rather small; body rather slender; size small. MACULOSUS, 1553.

*ff.* Preopercle without salient angle; body, head, and fins dark reddish brown, profusely covered with small pearly-white stellate spots; body robust; lower jaw projecting; caudal subtruncate, with sharp angles. DRUMMOND-HAYI, 1554.

*aa.* Second dorsal spine elevated, not lower than third or fourth; caudal fin lunate; preopercular angle little salient, without enlarged teeth; interorbital width 7½ in head; color brown, clouded with whitish; lower parts flushed with orange red; small dark spots about eye; vertical fins broadly edged with blue black. MORIO, 1555.

### Subgenus SCHISTORUS, Gill.

### 1545. EPINEPHELUS MYSTACINUS* (Poey).

(Cherna de lo Alto.)

Head $2\frac{3}{7}$; depth $2\frac{8}{9}$; eye large, $4\frac{1}{2}$ in head. D. XI, 15; A. III, 9; scales 18–120–50, pores 75. Body oblong, rather deep, somewhat compressed, its thickness $2\frac{2}{5}$ in its depth. Head large, rather obtuse, the anterior profile little convex and not steep. Mouth moderate, the broad maxillary reaching posterior border of eye, $2\frac{1}{4}$ in head; maxillary naked or nearly so. Teeth rather strong, those below mostly biserial, those above in a narrow band; canines small, shorter than the depressible teeth of the inner series, those of the lower jaw scarcely differentiated; lower jaw little projecting. Posterior nostril larger than anterior, nearly round. Interorbital space slightly convex, 6 in head. Preopercle rather sharply serrate, the posterior limb nearly vertical, not emarginate, the angle nearly a right angle, its serrations considerably enlarged, coarse, variable in form, some of the lower ones usually hooked forward. Lower limb straight, its edge otherwise entire. Skull essentially as in other species of *Epinephelus*. Opercle with 3 distinct spines, larger than in any other of our species. Gill rakers short and thick, 15 below the angle. Scales mostly ctenoid, those on head small; none on the maxillary and few on lower jaw. Lower jaw with 5 or 6 large mucous pores on each side, more distinct than in our other species. Dorsal spines rather strong and high, the first nearly half the second, which is considerably higher than the tenth; third spine longest, $2\frac{2}{3}$ in head; second, fourth, fifth, and sixth but little shorter; soft dorsal rather high; caudal rounded, its longest ray $1\frac{2}{3}$ in head; anal rounded, its longest ray $2\frac{1}{6}$ in head; second anal spine stronger than third, which is of the same length, $3\frac{3}{5}$ in head; pectorals reaching slightly beyond tips of ventrals, $1\frac{2}{3}$ in head; ventrals rather long. Pyloric cœca many, according to Poey. Color in life, dull olive brown, the body grayish brown crossed by 8 bands of dark olive brown, the one on caudal peduncle broader than the others, darkest on back of tail; these bands, which are more conspicuous in life than those of other species of this genus, become faint in spirits; a dark mustache along edge of maxillary; three dark bands across cheek, almost disappearing in spirits; dorsal dull olive, the bands of sides extending on the scaly parts; caudal and anal dull olive, the anal dusky in spirits; ventrals blackish; pectorals light olive brown; mouth bluish within. West Indies, south to Brazil; not rare. It inhabits deeper water than most species of *Epinephelus*. Size small; length about 2 feet; the specimen here described from Havana, 10 inches long. (μύσταξ, mustache.)

*Serranus mystacinus*, Poey, Memorias, i, 52, 1851, pl. 10, fig. 1, Cuba; Günther, Cat., i, 109, 1859.

*Schistorus mystacinus*, Poey, Repertorio, ii, 154, 1868.

*Epinephelus mystacinus*, Jordan & Swain, *l. c.*, 383, 1884; Jordan & Eigenmann, *l. c.*, 360, 1890.

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* This species is referred by Dr. Boulenger to the synonymy of *Epinephelus septemfasciatus* (Thunberg). It is evidently closely allied to this Japanese form, but we hesitate to unite them without material for comparison.

## Subgenus EPINEPHELUS.

### 1546. EPINEPHELUS ANALOGUS, Gill.

(Cabrilla Pinta.)

Head $2\frac{3}{5}$ to 3; depth 3 to $3\frac{1}{4}$; eye rather large, $5\frac{3}{4}$ in head. D. X, 17; A. III, 8; scales 14–110 to 120–40, pores 70 to 73. Body oblong, rather robust. Head moderately acute, the anterior profile straight from tip of snout to above eye, thence moderately convex; snout short, $4\frac{3}{4}$ in head. Mouth large, oblique, the maxillary reaching to beyond eye, its length $2\frac{1}{4}$ in head. Maxillary naked. Lower jaw strongly projecting. Canine teeth short, those of lower jaw small. Interorbital space gently convex, its width $7\frac{3}{8}$ in head. Nostrils round, subequal. Preopercle well serrate, its outline strongly convex, without distinct emargination. Gill rakers moderate, about as long as gill fringes, 17 or 18 below angle of arch. Scales moderate, rather strongly ctenoid, mostly cycloid above. Dorsal spines rather strong, the third and fourth subequal, $3\frac{1}{8}$ in head; caudal fin slightly rounded, $1\frac{9}{10}$ in head; anal high, its longest ray $2\frac{2}{5}$ in head. Second anal stronger than third, but rather shorter, 5 in head; pectorals reaching beyond tips of ventrals, $1\frac{5}{6}$ in head; ventrals shortish, not reaching vent. Color in spirits: Brown, clouded with darker and with faint dusky cross bars; body and fins everywhere covered with roundish dark-brown spots, larger and fewer below, smallest and most numerous on the fins, and everywhere very distinct; soft dorsal with 3, spinous dorsal with about 2 rows of dark spots. In life, orange brown on an olivaceous ground, as in *E. adscensionis*, to which species, as the name indicates, this fish is extremely analogous. No distinct dusky edgings to fins; no evident dark blotches along base of dorsal. Length 1 foot. Pacific Coast of tropical America; common on the Pacific Coast of Mexico. Here described from No. 4944, U. S. Nat. Mus., from Panama. (*analogus*, similar; its form and coloration resembling those of *Epinephelus adscensionis*.)

*Epinephelus analogus*, Gill, Proc. Ac. Nat. Sci. Phila., 1863, 163, Panama, (Coll. Dow), Jordan & Swain, *l. c.*, 393, 1884; Jordan & Eigenmann, *l. c.*, 354, 1890.

*Serranus courtadei*, Bocourt, Ann. Sci. Nat. Paris, 222, 1868, La Union, San Salvador. (Coll. Bocourt.)

### 1547. EPINEPHELUS ADSCENSIONIS (Osbeck).

(Rock Hind; Cabra Mora.)

Head $2\frac{2}{5}$; depth 3; eye moderate, 6 in head. D. XI, 17; A. III, 7, or III, 8; scales 12–90 to 110–40, pores 55 or 60. Body comparatively robust, little compressed, the greatest thickness 2 in depth. Head subconic, acute, its anterior profile straight from tip of snout to nape, thence slightly gibbous. Mouth rather large, the maxillary reaching rather beyond the eye, $2\frac{1}{8}$ in head. Lower jaw rather strongly projecting, more prominent than in any other of our species. Teeth in rather broad bands, the canines short and stout, those of the lower jaw larger than those of the upper. Interorbital space flattish, not very narrow, its width 6 in head. Nostrils subequal, roundish. Preopercle finely serrate, its outline strongly convex, with a very slight emargination. Gill rakers rather short and thick, 15 to 18 below the angle. Scales moderate, mostly strongly ctenoid. Dorsal spines rather strong, the third and fourth longest, 3⅕ in head, the outline of the fin little convex, the second spine about as long as tenth; caudal fin slightly rounded, 2 in head; longest anal ray 2½; second anal spine stronger than third, the length equal, 3⅚ in head; pectorals broad, reaching much beyond the tips of the short ventrals, 1⅘ in head; ventrals not reaching vent. Pyloric cœca 12 (Poey). Color in life: Olivaceous gray, with darker clouds; a number of irregular whitish blotches, roundish, mostly rather larger than pupil, scattered over different parts of the body; 5 roundish, blackish blotches, ill-defined along sides of back, the 4 under the dorsal fin extending up on the fin, these disappearing with age; head and body everywhere covered with round orange-brown spots of varying sizes, the centers more orange, the borders rather brown; the spots largest on breast, smallest on lips and upper parts, equally distinct everywhere. Mouth pale within, its roof with red spots; dorsal light olive, with rather sparse spots, colored like those of the body, but smaller; no dark edge to dorsal or anal; numerous whitish spots on dorsal, especially on soft dorsal; caudal pale olive, with some paler spots. Anal reddish, marked like dorsal, its spots larger; basal half of pectoral similar, outer part plain olive; ventrals pale, with orange spots; the orange-brown spots of body and head become brown in spirits. Length about 18 inches. West Indian fauna; Florida Keys to Brazil, Ascension and St. Helena islands; common in rocky places; widely distributed through the Western Atlantic; recorded by Boulenger from the Cape of Good Hope. It is considered a finer food-fish than any of the others. (*adscensionis*, from Ascension Island, where the species was first taken.)

*Pira-pixanga* or *Gat-visch*, MARCGRAVE, Hist. Brasil, 152, 1648, Brazil (doubtful).

*Perca tota maculis*, SEBA, Thesaurus, III, tab. 27.

*Trachinus adscensionis*, OSBECK, Iter Chin., etc., 1757, and in English edition, 96, 1771, Ascension Island. (Coll. Osbeck.)

*Trachinus punctatus*, BONNATERRE, Tableau Encycl. Method, 1788, 46; after OSBECK.

*Perca stellio*, WALBAUM, Artedi Piscium, 349, 1792; after SEBA.

*Perca maculata*, BLOCH, Ichthyol., pl. 313, 1792, Martinique (on a figure by PLUMIER; not *Holocentrus maculatus*, BLOCH, tafel 242, an East Indian species of *Epinephelus* = *Holocentrus albofuscus*, LACÉPÈDE).

*Trachinus osbeck*, LACÉPÈDE, Hist. Nat. Poiss., II, 364, 1800; after OSBECK.

*Sparus atlanticus*, LACÉPÈDE, *l. c.*, IV, 158, pl. 5, fig. I, 1803, Martinique (on a copy of a drawing by PLUMIER).

*Serranus nigriculus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., II, 375, 1828, Martinique. (Coll. Plée.)

*Serranus pixanga*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., II, 383, 1828, after MARCGRAVE; POEY, Repertorio, I, 203, 1866.

*Serranus aspersus*, JENYNS, Voy. Beagle, Fishes, 6, 1842, Porto Praya, St. Jago, of the Cape Verde Islands. (Coll. Darwin.)

*Serranus impetiginosus*, MÜLLER & TROSCHEL, Schomburgk's Hist. Barb., 665, 1848, Barbadoes; GÜNTHER, Cat., I, 142, 1859.

*Serranus varius*, BOCOURT, Ann. Sci. Nat. (5), X, 1868, 222, Gulf coast of Mexico. (Coll. Salard & Boucard.)

*Holocentrus punctatus*, BLOCH, Ichthyol., VIII, pl. 241, 1790.

*Serranus maculatus*, PETERS, Berliner Monatsber., 1865, 109 (identification of *Perca maculata*, BLOCH).

*Epinephelus punctatus*, Poey, Enumeratio, 16, 1875.
*Epinephelus atlanticus*, Jordan & Gilbert, Synopsis, 918, 973, 1883.
*Epinephelus ascensionis*, Jordan & Swain, Proc. U. S. Nat. Mus., 1884, 391.
*Epinephelus adscensionis*, Jordan & Eigenmann, *l. c.*, 354, 1890; Boulenger, Cat., i, 228.
*Epinephelus aspersus*, Jordan & Eigenmann, *l. c.*, 358.

### 1548. EPINEPHELUS GUAZA (Linnæus).

(Merou; Méro; Guasa.)

Head 2⅓; depth 2¾; eye 5¾ in head. D. XI, 15; A. III, 8; scales 12 to 17–100 to 120–42 to 55, pores 55 to 60. Body rather deep; profile steep; snout short, rather pointed; lower jaw little projecting; canines small; preopercle without salient angle, the teeth just above the angle large and strong; lower limb of preopercle entire. Scales of head cycloid. Gill rakers very short, x + 15. Interorbital space narrow, not as wide as eye; maxillary naked, 2⅖ in head. Third dorsal spine highest, 2¾ in head; anal high and rounded, its second spine 5 in head; caudal rounded; pectoral 1½ to 2 in head; ventral short, not reaching vent. Color in spirits: Dark brown, with rather faint, round, whitish spots which are irregular, and arranged somewhat in vertical rows, and most distinct on caudal peduncle; dorsal, anal, caudal, and pectorals broadly edged with black. Coasts of southern Europe and western Africa, ranging north to England and westward to Cape of Good Hope and Rio Janeiro, and to Guiana; reaching a length of 3 feet, and weight of about 25 pounds. This description is taken from No. 4506, M. C. Z., 15 inches long, collected at Rio de Janeiro by Professor Agassiz. There is not much doubt that *Epinephelus brachysomus*, Cope, and the Brazilian specimens referred by Cuvier & Valenciennes to *Epinephelus dichropterus*, belong to this form, for which the earliest American specific name is *mentzeli*. We are, however, unable to see any difference between the Brazilian form and the common "Mérou" of the Mediterranean. (*Guasa* or *Guaza*, Spanish name of the large fishes called *Mérous* or *Garrupas.*) (Eu.)

*Labrus guaza*, Linnæus, Syst. Nat., Ed. x, 1758, 285, "Habitat in Pelago.
*Perca gigas*, Brünnich, Ichthyol. Massiliensis, 65, No. 81, 1768, Marseilles.
*Holocentrus merou*, Lacépède, Hist. Nat. Poiss., iv, 377, 1803, Marseilles; after Brünnich.
*Serranus mentzeli*, Cuvier & Valenciennes, Hist. Nat. Poiss., ii, 291, 1828, coast of Brazil; Günther, Cat., i, 140, 1859.
*Perca robusta*, Couch, Mag. Nat. Hist., 1832, v, 21, fig. 7, Polperro, Cornwall.
*Serranus marginatus*, Lowe, Proc. Zoöl. Soc. Lond., 1833, 142, Madeira. (Coll. R. T. Lowe.)
*Serranus fimbriatus*, Lowe, Trans. Cambr. Phil. Soc., 1836, 195, pl. i, Madeira. (Coll. R. T. Lowe.)
*Serranus ongus*, Günther, Cat., i, 142, 1859; not *Epinephelus ongus*, Bloch, a Japanese fish.
*Epinephelus brachysomus*, Cope, Trans. Am. Phil. Soc. Phila., 1871, 466, Rio Janeiro.
*Serranus gigas*, Cuvier & Valenciennes, Hist. Nat. Poiss., ii, 270, pl. xxxii, 1828; Günther, Cat., i, 132, 1859, and of European authors generally.
*Cerna gigas*, Doderlein, Rivista del Genere *Epinephelus o Cerna*, 1882, 10, tab. 1, fig. 1 (detailed description and synonymy).
*Epinephelus gigas*, Jordan & Swain, Proc. U. S. Nat. Mus., 1884, 388; Jordan & Eigenmann, *l. c.*, 359; Boulenger, Cat., i, 232.

### 1549. EPINEPHELUS LABRIFORMIS (Jenyns).

Head 2½; depth 3. D. XI, 15; A. III, 8; scales 9–90 to 100–40, pores 55 to 57. Body oblong, moderately compressed, the back somewhat elevated. Head rather slender and sharp, anteriorly pointed, the profile nearly straight from the tip of the lower jaw to the base of the dorsal. Snout sharp, 3⅘ in head. Lower jaw strongly projecting. Mouth moderate, the maxillary extending to slightly beyond eye, its length 2⅕ in head. Maxillary naked. Canines moderate, about equal in the 2 jaws. Nostrils subequal, roundish. Eye large, 5½ in head. Interorbital space narrow, convex, its width 9 in head. Preopercle weakly and bluntly serrate, its angle evenly rounded, without evident notch or salient angle. Gill rakers rather short, about 16 on lower limb of arch. Scales moderate, ctenoid. Dorsal spines strong, the fourth, fifth, and sixth longest, 3 in head. Soft dorsal not very high. Caudal slightly convex, 2⅛ in head. Longest anal ray 2⅔ in head. Second anal spine about as long as third, 4⅛ in head. Pectorals short, reaching little past tips of ventrals, 1⅘ in head. Ventrals not quite reaching vent. Color in spirits: Dark brown everywhere, on head, body, and fins much clouded with roundish pale blotches, these most distinct on breast and lower parts of head; a conspicuous black blotch on back of caudal peduncle; fins rather pale, darker toward their edges, with narrow, pale margin, spotted like the body, the spots smaller and fainter. In life, the mouth is salmon color within, the pectoral salmon yellow, with pale edge; caudal with a maroon band above and below; dorsal edged with blackish red; spots on sides and belly nearly white. Length 2 feet. Pacific Coast of tropical America; Cape San Lucas to the Galapagos Islands, abundant in rocky places; here described from 28213, U. S. N. M., from Socorro Island. Specimens seen from Cape San Lucas, Mazatlan, Manzanillo, Acapulco, Panama; Socorro, Albemarle, Charles, and Indefatigable islands. (*Labrus*; *forma*, form.)

*Serranus labriformis*, JENYNS, Zoöl. of Beagle, Fishes, 8, pl. 3, 1840, Galapagos Islands, (Coll. Charles Darwin).

*Epinephelus sellicauda*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 250, Cape San Lucas, (Coll. Xantus); JORDAN & SWAIN, *l. c.*, 385.

*Epinephelus ordinatus*, COPE, Trans. Am. Phil. Soc., 1871, 466, Panama.

*Epinephelus labriformis*, GÜNTHER, Cat., I, 152, 1859; dark blotch on back of tail not noticed; JORDAN & SWAIN, *l. c.*, 1884, 387; JORDAN & EIGENMANN, *l. c.*, 356, 1890; BOULENGER, Cat., I, 230.

### 1550. EPINEPHELUS FLAVOLIMBATUS, Poey.

(YELLOW-FINNED GROUPER.)

Head 2⅓; depth 2¾. D. XI, 14; A. III, 9. Lower jaw strongly projecting. Closely related to *Epinephelus niveatus*, with which it seems to agree in all respects except in color. Color in life: Brownish flesh color, unspotted, a clear, blue streak from angle of eye to preopercle; no spots or blotches anywhere, and no black on caudal peduncle; whole dorsal with a narrow edge of bright yellow; dorsal, pectorals, anal and caudal without pale edging; ventrals dusky; a very faint mustache of dark olive along the maxillary. Three specimens of this species have been obtained at the Snapper Banks off Pensacola by Mr. Silas Stearns. These differ a little from Poey's account, but they evidently belong to the same species as the *E. flavolimbatus* of Poey. In all details of form, the species seems to agree fully with *E. niveatus*, but the coloration is quite unlike that of the latter species, and so sharply defined that we are obliged to admit it as a distinct species. It may, nevertheless, prove to be the adult of *Epinephelus niveatus*, as supposed by Dr. Boulenger. West Indies, recorded from Havana and Pensacola, in rather deep water; not common. Our specimens from the Pensacola Snapper Banks. (*flavus*, yellow; *limbus*, edge.)

*Epinephelus flavolimbatus*, POEY, Repertorio, I, 183, 1867, Cuba; POEY, Synopsis, 286, 1868; JORDAN & EIGENMANN, *l. c.*, 357, 1890.

*Epinephelus niveatus*, JORDAN & EVERMANN, Proc. U. S. Nat. Mus., 1886, 475.

### 1551. EPINEPHELUS NIVEATUS (Cuvier & Valenciennes).

Head 2⅓; depth 2$\frac{9}{10}$. D. XI (rarely X), 14 or 15; A. III, 9; scales 18–115 to 120–50, pores 67 to 75. Body oblong, compressed, the back elevated; the anterior profile somewhat convex; the snout short, rather sharp, its length 3¾ in head. Mouth large, the maxillary extending to below posterior margin of eye, its length 2 in head. Canines rather strong, especially in upper jaw. Lower jaw considerably projecting. Eye rather large. Preopercle with its angle decidedly salient, armed with stronger teeth, the emargination above the angle slight. Interorbital space flattish, its width 7½ in head. Gill rakers moderate, the longest as long as gill fringes, about 15 on lower limb of arch. Scales moderate. Dorsal spines rather high, the fourth about 2⅗ in head; soft dorsal of moderate height; caudal truncate, 2 in head; anal moderate, its second anal spine about as long as third, 2⅔ in head; longest soft ray 2⅓. Pectorals not reaching to the tips of the long ventrals, 1$\frac{9}{10}$ in head. Ventrals nearly reaching vent, about as long as pectorals. Color of young specimen in alcohol: Brown, with round whitish spots on the body, rather smaller than pupil, regularly arranged in vertical and horizontal series, about 5 in horizontal and 4 in vertical row; these rows sometimes show irregularities; no distinct spots on breast; a very large black blotch on upper part of caudal peduncle, much larger than in *E. labriformis* and extending to below lateral line; a dark mustache above edge of maxillary; fins nearly plain, probably yellowish in life, the dorsal with a median row of round dusky spots on the membranes. (Description from young specimen 6¼ inches long.) West Indies to Brazil (Rio Grande do Sul); not very common; occasionally northward in the Gulf Stream as far as Newport, Rhode Island. Some specimens lack the saddle-like blotch on the tail, but in all the pearly spots on the side are persistent. (*niveatus*, snowy.)

*Serranus niveatus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., II, 380, 1828, Brazil; GÜNTHER, Cat., I, 130, 1859.

*Serranus margaritifer*, GÜNTHER, Cat., I, 131, 1859, South America.

*Serranus conspersus*, POEY, Memorias, II, 139, 1860, Havana.

*Hyporthodus flavicauda*, GILL, Proc. Ac. Nat. Sci. Phila., 1861, 98; young specimen, taken at Newport, Rhode Island. (Coll. Samuel Powell.)

*Epinephelus niveatus*, POEY, Synopsis, 286, 1868; JORDAN & GILBERT, Synopsis, 541, 1883; JORDAN & SWAIN, *l. c.*, 386, 1884; JORDAN & EIGENMANN, *l. c.*, 357, 1890; BOULENGER, Cat., I, 226.

### 1552. EPINEPHELUS STRIATUS (Bloch).

(Nassau Grouper; Hamlet; Cherna Criolla.)

Head $2\frac{4}{7}$; depth $2\frac{7}{9}$; eye rather large, $5\frac{1}{2}$ in head (young). D. XI, 17; A. III, 8; scales 13 to 18–110 to 125–45 to 55, pores 55 to 65. Body rather deep, not strongly compressed, its greatest width $2\frac{2}{5}$ in depth. Head somewhat pointed; the anterior profile nearly straight to the front of the dorsal. Mouth moderate, the lower jaw little projecting; the maxillary reaching posterior border of eye, $2\frac{1}{3}$ in head. Teeth in moderate bands; 2 moderate canines in front of each jaw, the lower smallest. Nostrils close together, the posterior a little the larger, ovate. Interorbital space narrow, flattish, or somewhat concave, $8\frac{1}{2}$ in head. Angle of preopercle slightly salient, a shallow notch above it; the teeth at the angle somewhat larger. Gill rakers slender, about 16 below the angle. Scales moderate, strongly ctenoid. Dorsal spines of moderate strength, higher than in most species, the second much higher than tenth, the third highest, $2\frac{1}{2}$ in head; soft dorsal rather high; caudal rounded, $1\frac{5}{7}$ in head; soft anal rounded, the largest ray $2\frac{1}{4}$ in head; second anal spine stronger than third and about as long, 4 in head; pectorals reaching tips of ventrals, $1\frac{7}{9}$ in head. Ventrals short, barely reaching vent. Color in life: Rather pale olivaceous gray, paler below, and with obscure whitish clouds along sides; body with about 4 vertical bars, very irregular and undulating, of an olive-brown color, darker on the back, and all extending on the dorsal fin; a square blotch of jet black on back of tail; a band of dark olive through eye and on snout, meeting its fellow on shoulder just before dorsal; another on median line of snout, forking opposite front of eye, the 2 bands extending backward parallel and ceasing abruptly on occiput without reaching the other band; dark shades radiating from eye below; a ring of deep brown or blackish points around eye, the upper ones on eye; a deep orange-red stripe on lower edge of preorbital; mouth within partly orange; lower parts of head and breast tinged with orange and with coppery cloudings; vertical fins colored like the parts of the body nearest them; edge of both dorsals yellow; caudal and anal tipped with orange yellow; ventrals blackish, faintly yellowish at tips; pectorals chiefly light orange, dusky at base; bands and dark markings of body becoming fainter in old examples of this species, and almost disappearing in alcoholic specimens. West Indies, Key West to Brazil; very common; a well-marked species and a food-fish of importance. Length 3 feet; those usually found in the markets much smaller. (*striatus*, striped.)

*Cherna*, Parra, Dif. Piezas Hist. Nat., 1787, 50, lam. 24, Havana.

*Anthias striatus*, Bloch, Ichthyologia, IX, 109, pl. 324, 1792, Martinique; on a figure by Plumier.

*Anthias cherna*, Bloch & Schneider, Syst. Ichth., 310, 1801, Cuba; after Parra.

*Sparus chrysomelanurus*, Lacépède, Hist. Nat. Poiss., IV, 160, 1803, Martinique; on a copy of Plumier's figure.

*Serranus striatus*, Cuvier & Valenciennes, Hist. Nat. Poiss., II, 288, 1828; Günther, Cat., I, 1859, 110.

*Epinephelus striatus*, Jordan & Eigenmann, *l. c.*, 356, 1890; Boulenger, Cat., I, 235.

### 1553. EPINEPHELUS MACULOSUS (Cuvier & Valenciennes).

(CABRILLA; RED HIND.)

Head 2½; depth 3⅓; eye large, 4⅓ in head, rather longer than snout. D. XI, 16; A. III, 8; scales 19–100–x. Body rather slender, moderately compressed, the back somewhat elevated, the greatest thickness of the body 2⅖ in its greatest depth. Head rather long and pointed, its anterior profile regularly and rather weakly arched. Mouth not very large, the maxillary reaching to below posterior margin of eye, its length 2⅓ in head; lower jaw rather weak, its tip little projecting; teeth rather strong, in moderate bands; both jaws with two moderate, curved canines, those in the upper jaw largest. Interorbital space very narrow, anteriorly concave, its width 11 in head; nostrils small, round, close together, the posterior largest. Preopercle weakly serrate, with a salient angle, which is armed with stronger teeth; a shallow emargination above the angle. Gill rakers slender, longer than gill fringes, 15 to 17 developed below. Scales of moderate size, rather strongly ctenoid. Dorsal spines rather slender but pungent, the second spine considerably higher than the tenth, the third and fourth longest, 2½ in head; soft rays lower than the highest spines; caudal fin rounded, its length 2 in head; anal rather high, posteriorly rounded, its longest soft rays 2⅖ in head; second anal spine somewhat stronger than third and rather longer, 3 in head; pectorals rather narrow, reaching past tips of ventrals, 1⅔ in head; ventrals short, not reaching vent. Color in life: Light yellowish olive above, whitish below; three broad, oblique, obscure bands of olive running upward and backward on sides; spots on body vivid scarlet red, those above a little darker, the edges of the scales being brown; inside of mouth mostly pale, partly scarlet; belly spotted; dorsal olive yellow, somewhat clouded, a few red spots on spinous dorsal; soft dorsal broadly edged with black; caudal yellowish, the posterior half black, its edge white; anal like soft dorsal; pectorals light yellow, with rows of small scarlet spots; ventrals red, blackish at tips; branchiostegal membrane spotted like body. The olive bands on sides disappear in spirits, and the red spots above become brown, those below gray. West Indies; Carolina to Brazil. This is one of the smaller species of the genus, rarely exceeding 18 inches in length; very abundant in the Havana market, West Indies; occasionally north to Charleston, the Florida Keys, and the Bermudas; south to Brazil; here described from Havana specimens. (*maculosus*, spotted.)

*Cugupuguacu Brazil*, the Hind, CATESBY, Nat. Hist. Carolina, etc., pl. 14, 1743, Bahamas; not of MARCGRAVE.

*Cabrilla*, PARRA, Dif. Piezas, Hist. Nat. Cuba, 1787, Havana.

*Lutjanus lunulatus*, BLOCH & SCHNEIDER, Syst. Ichthyol., 329, 1801; after *Cabrilla* of PARRA; not *Lutjanus lunulatus* (Mungo Park).

*Serranus apua*,* CUVIER & VALENCIENNES, Hist. Nat. Poiss., II, 287, 1828; not *Bodianus apua*, BLOCH; GÜNTHER, Cat., I, 140, 1859.

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* We reject the name *apua* formerly used by us for this species, the original *Bodianus apua* of Bloch being in our opinion based on the red variety of *Mycteroperca venenosa*. The name *guttatus*, Linnæus, is based chiefly on the *Cugupuguacu* of Marcgrave; with which Catesby had erroneously identified his "Hind," which is the present species. The oldest tenable name of this fish, so far as we can see, is *Epinephelus maculosus*.

*Serranus maculosus*, Cuvier & Valenciennes, *l. c.*, II, 332, 1828. (Type, No. 7360, Mus. Paris. Examined by Dr. Boulenger.)

*Serranus catus*, Cuvier & Valenciennes, *l. c.*, II, 373, 1828, Martinique.

*Serranus arara*, Cuvier & Valenciennes, *l. c.*, II, 377, 1828, Havana; erroneously identified with *Bonaci arará* of Parra.

? *Serranus angustifrons*,* Steindachner, Verh. Ges. Wien, XIV, 1864, 230, pl. VII, fig. 213, Cuba.

*Epinephelus cubanus*, Poey, Repertorio, I, 202, 1867, Cuba.

*Serranus stadthouderi*, Vaillant, Miss. Sci. Mex., Poiss., 69, 1877; based on *Serranus maculosus*, Cuvier & Valenciennes, the name regarded as preoccupied by *Serranus maculatus*, which is *adscenscionis*.

*Serranus lunulatus*, Cuvier & Valenciennes, *l. c.*, II, 379, 1828; after Parra.

*Epinephelus lunulatus*, Poey, Synopsis, 286, 1868.

*Epinephelus guttatus*, Jordan & Gilbert, Synopsis, 919, 973, 1883; wrongly identified with *Perca guttata*, Linnæus.

*Epinephelus apua*, Jordan & Swain, Proc. U. S. Nat. Mus., 1884, 389.

*Dermatolepis angustifrons*, Jordan & Eigenmann, *l. c.*, 375, 1890.

*Epinephelus catus*, Jordan & Eigenmann, *l. c.*, 355, 1893; Boulenger, Cat., I, 210.

### 1554. EPINEPHELUS DRUMMOND-HAYI, Goode & Bean.

(Speckled Hind; John Paw.)

Head 2⅔; depth 2⅔; eye 6 to 8 in head. D. XI, 16; A. III, 9; scales 32–125–57. Body robust; lower jaw strongly projecting; preopercle evenly serrate, without salient angle; caudal truncate or slightly emarginate, the angles acute. Dark umber brown, densely covered with small pearly white spots, those below smaller and nearly round, all arranged in somewhat irregular series; fins not dark-edged, all covered with similar spots, those of the paired fins chiefly on the inner surface; lower side of head flushed with red and unspotted; caudal fin more densely spotted than body, the terminal spots of a fine lavender; pectoral with a subterminal band of orange. Reaches a weight of 30 pounds. Gulf of Mexico, north to the Bermudas, once recorded from Charleston; common on the Snapper Banks off Pensacola, where it is a valued food-fish; the most beautiful in color of all the groupers. (Named for "Col. H. M. Drummond-Hay, C. M. Z. S., of Leggieden, Perth, Scotland, formerly of the British army, by whom the species was first discovered at the Bermudas in 1854.")

*Epinephelus drummond-hayi*, Goode & Bean, Proc. U. S. Nat. Mus., 1878, 173, 174, Pensacola, (Coll. Silas Stearns); Bermuda; (Coll. Lieut. Drummond-Hay); Jordan & Gilbert, Synopsis, 540, 1883; Jordan & Swain, *l. c.*, 388; Jordan & Eigenmann, Proc. U. S. Nat. Mus., 1887, 269; Jordan & Eigenmann, *l. c.*, 356, 1890; Boulenger, Cat., I, 224.

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* *Epinephelus angustifrons* (Steindachner): Head 3; depth 4. D. XI, 17; A. III, 8. Body very strongly compressed; scales very small, ctenoid; interorbital space not half diameter of eye, which is 4½ in head, 1½ in snout; maxillary reaching middle of eye; angle of preopercle salient, with 5 to 7 strong teeth, the two lowermost being turned forward; lower limb of preopercle entire; third dorsal spine highest, twice diameter of eye; anal spines graduated; pectoral as long as from snout to edge of preopercle, a little longer than caudal, much longer than ventral; caudal triangular; dorsal and anal rounded. Color brown, the scales edged with darker; fins brownish, blackish toward tips of first dorsal. Cuba; not seen by us; referred by Dr. Boulenger to the synonymy of *Epinephelus maculosus*, a species to which it is evidently related. The very narrow interorbital area is the chief basis of this identification as the color markings of *Epinephelus maculosus* are not indicated in the account of *angustifrons*. We know nothing of this species except what is contained in the original description. (*angustus*, narrow; *frons*, forehead.)

### 1555. EPINEPHELUS MORIO (Cuvier & Valenciennes).

(RED GROUPER; CHERNA AMERICANA; CHERNA DE VIVERO; NÈGRE.)

Head 2½; depth 2⅘; eye large, 5 in head (young). D. XI, 16–17; A. III, 9, rarely III, 8; scales 18 or 20–130 to 140–60, pores 60 to 65. Body comparatively deep and compressed, highest under front of spinous dorsal, its greatest width 2½ in greatest depth. Head large, moderately pointed, the anterior profile rather steep and nearly straight. Mouth rather large, the maxillary reaching slightly beyond eye, its length 2⅕ in head. Lower jaw not strongly projecting. Teeth moderate, in rather narrow bands; 2 moderate canines in the front of each jaw, the lower smaller. Interorbital space narrow, its width 7½ in head, the outline of the bone (under the flesh) transversely concave. Nostrils small, round, subequal. Preopercle moderately serrate, its angle slightly salient; teeth at the angle a little enlarged. Gill rakers rather slender, about 15 below the angle. Scales small, mostly ctenoid. Dorsal spines high, slender but pungent, the first less than halt the second, which is highest, 2⅓ in head; the outline of the fin thence almost straight to the tenth spine, which is 1¾ in the second; soft dorsal not elevated; caudal fin lunate, the outer rays a little produced, 1⅔ in the head; caudal peduncle comparatively slender; soft part of anal rounded, its longest ray 2¾ in head; second anal spine somewhat stronger but not longer than third, 4⅙ in head Pectorals reaching slightly beyond tips of ventrals, 1⅘ in head; ventrals short, not reaching vent. Pyloric cœca 25 (according to Poey). Color in life: Olive gray or olive brown, clouded with paler olive, with no clear red shades except on jaws and lower part of sides of head and breast, these regions being usually a salmon color; besides these, very irregular rounded blotches of grayish white over the body; preorbital, suborbital region, and snout with numerous round points of dark orange brown, most numerous on preorbital, these points brown in spirits; inside of mouth posteriorly bright orange; iris gilt; vertical fins colored like the body, the shades from the body extending on them; soft dorsal, anal, and caudal with a broad ridge of blue black, with a narrow whitish edge; spinous dorsal narrowly edged with blackish; ventrals slightly dusky; pectorals light olive. With age this species becomes more and more of a flesh red, especially below and on mouth; the pale spots and blotches are less distinct in old examples. Length 1 to 3 feet. Atlantic Coast of America, from Virginia to Rio Janeiro; the most abundant of the genus on our coasts; ranging farther northward than any other; a food-fish of importance; handsome in coloration. (*morio*, Moor, translation of the name *nègre* used at San Domingo.)

*Serranus morio*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., II, 285, 1828, New York and San Domingo; GÜNTHER, Cat., I, 142, 1859; POEY, Enumeratio, 15.

*Serranus erythrogaster*, DE KAY, New York Fauna: Fishes, 21, pl. 19, 1842, Florida; GÜNTHER, Cat., I, 133, 1859.

*Serranus remotus*, POEY, Memorias, II, 140, 1860, Havana.

*Epinephelus morio*, JORDAN & GILBERT, Synopsis, 510, 1883; JORDAN & SWAIN, Proc. U. S. Nat. Mus., 1884, 381.

*Epinephelus morio*, JORDAN & EIGENMANN, *l. c.*, 361, 1890; BOULENGER, Cat., I, 237.

## 501. GARRUPA, Jordan.

### (BLACK GROUPERS.)

*Garrupa*, JORDAN, Bull. U. S. Fish Comm., VIII, 1888 (1890), 353, (*nigritus*).

This genus contains very large groupers, closely allied to *Epinephelus*, but with the skull different in form so far as its upper surface is concerned. In *Garrupa** the skull is very broad and flat, the interorbital area is little concave, and the median ridge is scarcely evident; the occipital crest disappears before reaching the interorbital region; the outline of the skull above is everywhere more or less flattened; the top of the temporal crest points outward; the stay of the occipital crest meets the crest at right angles and does not form a groove between itself and the latter. A single species known, of very great size, its dorsal spines indifferently 10 or 11. Atlantic Ocean. (*Garrupa*, the Portuguese name of the large species of *Epinephelus*, transferred also to species of *Sebastodes*, and corrupted by the Americans into *Grouper* or *Groper.*)

### 1556. GARRUPA NIGRITA (Holbrook).

### (BLACK JEWFISH; BLACK GROUPER; MERO DE LO ALTO.)

Head 2½; depth 2½; eye very small, 6 to 8 in head. D. XI, 14 (*nigrita*), or X, 14 (*merus*); A. III, 9; scales 90 to 110. Body very robust; teeth in broad bands; canines strong, but growing smaller with age. Interorbital width 4½ in head; lower jaw projecting; maxillary scaly, about 2 in head, extending beyond eye; preopercle rounded, without salient angle, the young with enlarged teeth at the angle. Gill rakers short and thick, x + 12 to 14, the longest not twice as long as broad. Dorsal fin notched; second dorsal spine longest, its length 2 to 3 times in head, and half longer than third spine; caudal fin rounded; second anal spine shorter than third, 6 in head. Scales ciliated, those of lateral line of the ordinary type. Color plain chocolate brown, varying to blackish gray, without markings, or with faint pale blotches, the lower parts scarcely paler, the distal part of the vertical fins darker; a dark streak along edge of maxillary. South Atlantic and Gulf coast of the United States (Charleston to Pensacola) south to Cuba and Brazil, once straying to Sicily, rather common off the coast of Florida. This species reaches a weight of probably 500 pounds, about the same size as the largest known examples of *Promicrops guttatus* and *Stereolepis gigas*; but one specimen of less than 100 pounds weight examined by naturalists. None of the European *Serranidæ* reaches so large a size, the extreme weight of *Epinephelus guaza* being, according to Doderlein, about 50 kilograms; that of *E. caninus*, 90 kilograms. (*nigritus*, blackened.) (Eu.)

*Serranus nigritus*, HOLBROOK, Ichth. S. Carolina, Ed. 1, 173, pl. XXV, fig. 11, 1856, Charleston; GÜNTHER, Cat., I, 134, 1859.

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* In *Epinephelus morio* the skull is narrow and the upper surface rugose, the interorbital area is deeply concave, and the median crest, though low, is quite prominent; the occipital crest is sharp, and drawn out so that it gradually merges into the interorbital ridge; the outline of the skull immediately behind the orbit is convex; the tip of the temporal crest points inward to the occipital crest; the stay of the occipital crest forms a groove between it and the posterior part of the crest.

*Centropristis merus*,* POEY, Synopsis Piscium Cubensium, 288, 1868, Cuba; specimen with 10 dorsal spines.

*Cerna sicana*, DODERLEIN, Rivista delle Specie del Genere *Epinephelus* o *Cerna*, 1882, 81, Palermo; specimen with 10 dorsal spines.

*Epinephelus nigritus*, JORDAN & GILBERT, Synopsis, 540, 1883; JORDAN & SWAIN, *l. c.*, 1884, 380; JORDAN, Proc. U. S. Nat. Mus., 1885, 208; JORDAN & EIGENMANN, *l. c.*, 361, 1890; BOULENGER, Cat., I, 238.

*Epinephelus merus*, JORDAN & EIGENMANN, *l. c.*, 362, 1890.

## 502. PROMICROPS (Gill) Poey.

(GUASAS.)

*Promicrops* (GILL MS.) POEY, Synopsis Piscium Cubensium, 287, 1868; Ann. N. Y. Lyc. Nat. Hist., x, 1871, 42, (*guasa*).

*Itaiara*, VAILLANT & BOCOURT, Mission Scientifique au Mexique, 1875, 90, (*itaiara*).

Cranium short, extremely broad and depressed between the eyes, the anterior profile of the head more or less concave. Dorsal spines all low. Scales of the lateral line each with 4 to 6 radiating ridges. This genus is fairly well distinguished by the peculiarities of its cranium. One species is certainly known, a tropical fish of very large size, like the species of *Stereolepis* and *Garrupa*. Dr. Boulenger does not separate either *Promicrops* or *Garrupa* from *Epinephelus*. The relationship of each to *Epinephelus* is certainly very close. (*πρό*, before; *μῖκρός*, small; *ὤψ*, eye; in allusion to the shortness of the anterior part of the cranium.)

### 1557. PROMICROPS GUTTATUS (Linnæus).

(GUASA; SPOTTED JEWFISH; MERO.)

Head $2\frac{3}{5}$ to 3; depth $3\frac{1}{10}$; eye very small, 7 in head (in young), about 12 in adult. D. XI, 16; A. III, 8; scales 16–95 to 135–40, pores 60 to 70. Body more robust than in any species of *Epinephelus*, its greatest breadth $1\frac{2}{3}$ in the depth. Head very large, unusually broad, anteriorly obtuse,

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*The following description of the nominal species, *Garrupa merus* (Poey), characterized by the possession of 10 dorsal spines and by a more strongly armed preopercle, is taken from a specimen from Rio Janeiro, (No. 9737, Mus. Comp. Zool.; Coll. L. Agassiz): Head $2\frac{3}{5}$ in length of body; depth $2\frac{3}{5}$. D. X, 14; A. III, 9. Scales 86 (series). Second dorsal spine $2\frac{3}{5}$ in head; second anal spine 6. Pectoral $1\frac{4}{5}$; maxillary 2; eye 7; snout $3\frac{2}{3}$; interorbital area $4\frac{1}{2}$; soft dorsal rays $2\frac{2}{3}$ in head. Body very deep and short, deeper and more compressed than in *Epinephelus*. Head large and blunt, the anterior profile regularly convex; interorbital area broad, as in *Garrupa nigrita*, rather convex; eye small; mouth very large, the lower jaw projecting; supplementary maxillary small. Three or four very small canines in front of each jaw; no lateral canines. Nostrils round, near together, the posterior largest. Preopercle without salient angle, but rather coarsely serrate; two or three very coarse, irregular teeth just below angle, these turned downward much as in *Epinephelus mystacinus*. Opercular spine moderate. Gill rakers very short and thick, x + 12, the longest not twice as high as broad and all very coarsely toothed; preorbital moderate, nearly as broad as the small eye. Scales moderate, not very rough; dorsal fin rather deeply notched, the second spine highest, nearly three times the height of the first, but little higher than the third; soft dorsal high; caudal rounded; anal fin high, rounded, the spines moderate, graduated; pectorals short. Color, in spirits, plain dark brown; fins all darker; a dark mustache along the edge of the maxillary. In a young specimen from Rio Grande do Sul the caudal fin is abruptly paler. West Indies, recorded from off Cuba, Sicily, and Brazil. (*Merus*, from *mérou*, the French name of *Epinephelus guaza*, derived from Latin *morrhua*, codfish.) *Garrupa merus* is probably identical with *Garrupa nigrita*. The five known specimens of *Garrupa merus* (from Havana, Palermo, Rio Janeiro, Rio Grande do Sul) differ from *Garrupa nigrita* in having 10 dorsal spines instead of 11, no other distinction being evident. Often specimens of *Garrupa nigrita* from Pensacola, Florida, examined by us, one has 10 spines, the others 11. Probably all belong to one species, for which the oldest name is *nigrita*.

its profile depressed or slightly concave above the eye, convex at the nape. Snout very short, 4¾ in head; lower jaw projecting. Maxillary scaly. Mouth large, the maxillary, even in the young, reaching much beyond the eye, 2 in head, its tip in the adult as wide as eye. Teeth in broad bands, those of the outer series somewhat enlarged, the canines very small, scarcely differentiated, but present. Interorbital area flattish, very broad, its width 5 in head. Nostrils subequal, roundish, close to the eye. Preopercle convex, with a slight emargination, the angle a little prominent, with somewhat larger teeth. Opercular flap obtusely pointed, its upper edge curved. Opercular spines small and blunt. Gill rakers short and thick, few (about 12) in number. Scales comparatively large, mostly ctenoid. Scales of the lateral line each with 4 to 6 conspicuous radiating ridges separated by furrows. Dorsal spines low and strong, the third, fourth, and fifth subequal, 4 in head, the outline of the fin scarcely convex; second spine lower than tenth; caudal fin rounded, its outer rays very much shortened, little more than half the length of the middle rays, which are 1[illegible] in head. Anal rounded, its longest rays 2⅓ in head; second anal spine rather shorter than third and a little stronger, 4⅗ in head; pectoral reaching a little beyond tips of ventrals, 1⅔ in head; ventrals 2, not reaching vent. Pyloric cœca excessively numerous and finely divided. Color of adult nearly uniform dull olive brown, the spots and bands faint or obsolete. Young specimens in life pale olive green, slightly yellowish on breast and lower jaw, the body with 5 cross bars of dark olive green, with irregular but rather sharply defined edges, and extending on the dorsal and anal fin; 2 under spinous dorsal, 2 between soft dorsal and anal, 1 on caudal peduncle; these bars partially or wholly disappear in spirits; a dark blotch at nape; two shades down and backward from eye; a bar at base of caudal; round blackish spots smaller than pupil, of different sizes, scattered over the whole of head and nuchal region; a few along back; these smallest on upper part of head, largest on back and lower parts of sides of head; breast and belly plain; dorsal fin olive, with dark clouds like the body, a few spots on spines and tips of soft rays; caudal much clouded with dark, which form series of spots on the hinder parts, these spots smallest and best defined posteriorly. Anal similar to caudal; pectorals light olive, profusely covered with large dark spots; ventrals similar to pectorals, with fewer spots. Tips of pectorals and caudal slightly reddish. In spirits the dark bands and blotches of body are more or less faded. Length 2 to 6 feet. Both coasts of tropical America north to Florida and Gulf of California, south to Brazil; not uncommon about rocks; here described chiefly from a young specimen, 16 inches long, from Key West; specimens examined by us from Punta Arena, Mazatlan, Panama, Key West, Havana, Rio de Janeiro, Bahia, Pernambuco, and Cannarivieras. Dr. Boulenger records a specimen 5 feet 7 inches long from Clarence River, New South Wales. We are not able to separate the Pacific Coast form, *Promicrops quinquefasciatus*, from the Atlantic *guttatus*. (*guttatus*, spotted.)

*Cugupuguacu*, MARCGRAVE, Hist. Brazil, 169, 1648, Brazil.

*Perca guttata*, LINNÆUS, Syst. Nat., Ed. x, 1758, 292, Brazil; after MARCGRAVE, WILLUGHBY, SLOANE, CATESBY, etc.; the account of color taken from Catesby's figure of the Red Hind (*Epinephelus catus*); the various authors quoted each supposing his specimens to be identical with that of Marcgrave.

*Serranus itaiara*, LICHTENSTEIN,* Acta Berolinens. for 1821, 378, 1822, Brazil; CUVIER & VALENCIENNES, Hist. Nat. Poiss., II, 376, 1828; not *Itaiara*, MARCGRAVE.

*Serranus galeus*, MÜLLER and TROSCHEL, in Schomburgk's Reise in Brit. Guiana, 621, 1842, Guiana; GÜNTHER, Cat., I, 130, 1859.

*Serranus guasa*, POEY, Memorias Cuba, II, 141, 354, tab. 13, fig. 8, 1860, Cuba.

*Serranus quinquefasciatus*, BOCOURT, Ann. Sci. Nat., 1868, 223, Nagualate, Pacific Coast of Guatemala.

*Epinephelus quinquefasciatus*, JORDAN & GILBERT, Bull. U. S. Fish Comm., 1882, 106, 110, 112.

*Promicrops guasa*, JORDAN & GILBERT, Synopsis, 542, 1883.

*Epinephelus galeus*, JORDAN, Proc. Ac. Nat. Sci. Phila., 1883, 285.

*Epinephelus itaiara*, JORDAN, Proc. U. S. Nat. Mus., 1884, 124; BOULENGER, Cat., I, 252.

*Promicrops itaiara*, JORDAN & SWAIN, *l. c.*, 1884, 877.

*Promicrops guttatus*, JORDAN & EIGENMANN, *l. c.*, 363, 1890.

## 503. ALPHESTES, Bloch & Schneider.

*Alphestes*, BLOCH & SCHNEIDER, Syst. Ichthyol., 236, 1801, (*afer*).

*Prospinus*, (POEY MS.) GILL, Proc. Ac. Nat. Sci. Phila., 1862, 237, (*chloropterus* = *afer*).

The genus *Alphestes* contains two species of small fishes which differ from *Epinephelus* proper in the presence of a strong antrorse spine on the lower limb of the preopercle. Frontal bones with an anterior excavation for the reception of the posterior processes of the premaxillaries, a process or knob on each side of skull behind the interorbital area; supraoccipital and parietal crests produced on frontals, but not extending to between orbits. Dorsal rays XI, 17 to 20; anal III, 9. (ἀλφηστής, greedy or incontinent, a name applied to a kind of fish that swims in pairs, one behind the other, possibly *Symphodus tinca*.)

*a.* Second anal spine as long as third; gill rakers short. Color olive, clouded with dusky, the body with rather few dark-orange spots; breast with pearly spots; a dark mustache above the maxillary; lower jaw little projecting; preorbital very narrow. AFER, 1558.

*aa.* Second anal spine longer than third; gill rakers long, longer than gill fringes. Color olivaceous, the ground color nearly uniform, the body and fins closely covered with small dark-brown spots; breast plain; snout slender, pointed; lower jaw rather strongly projecting. MULTIGUTTATUS, 1559.

### 1558. ALPHESTES AFER (Bloch).

(GUASETA.)

Head $2\frac{4}{7}$; depth $2\frac{2}{3}$; eye large, $4\frac{1}{2}$ in head. D. XI, 17 to 19; A. III, 9; scales 10–75 to 80–35, pores 50 to 60. Body oblong, ovate, rather compressed, the greatest width $2\frac{1}{4}$ times in depth; head small, rather pointed, the profile nearly straight from the tip of the snout to the nape, there forming a considerable angle, being steeper and more gibbous to the front of the dorsal fin; snout short, shorter than eye; mouth small, the maxillary extending a little beyond the eye, its length $2\frac{2}{5}$ in head; maxillary naked; teeth comparatively small, in broad bands, the upper jaw

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*According to Professor Peters, the type of *Serranus itaiara* is a very young fish, with the eye as wide as the interorbital space, but in other respects identical with the type of *Serranus galeus*.

with about four small canines, the canines of the lower jaw scarcely differentiated; lower jaw rather weak, little projecting; interorbital space moderate, convex, its width 6 in head; preopercle strongly and unequally convex, its upper limb oblique, without notch above the angle; upper limb of preopercle with slender teeth, which regularly increase in size downward, those at the rounded angle strong; below the angle is a strong flattish spine, directed forward and downward, its length 4 in eye; nostrils small, round, close together; scales not very small, mostly cycloid, those on opercles larger than those on body, those on cheeks small; gill rakers short and stout, their length not more than half pupil, 14 to 16 below angle; dorsal spines rather short, robust, and pungent, the second higher than the tenth, the fourth and fifth highest, 2⅓ in head, the outline of the fin gently curved; soft rays about as high as third spine; caudal convex behind, its angles rounded, its length 1⅗ in head; anal rather high, posteriorly rounded, its longest soft rays 2 in head; second anal spine longer and stronger than third, 2⅔ in head; pectorals broad, rounded, extending beyond tips of ventral, 1⅗ in head; ventrals nearly or quite reaching vent. Color in life, dark brownish olive, mottled with darker blotches; body with some dark orange spots; vertical fins dark olive, mottled with darker blotches; lower parts of head yellow; pectorals dull olive red, with bluish spots; ventrals dull olive, edged with darker; some pearly spots on breast and on anal; mustache dark red brown; the orange spots become brown in spirits. Length about a foot. West Indies; Cuba to Brazil; generally common; the specimen here described from Havana; recorded by Dr. Boulenger from the Falkland Islands; only the original type of Bloch recorded from Africa. (*afer*, African.)

*Epinephelus afer*, BLOCH,* Ichthyologia, pl. 327, 1793, Acará in Guinea; (Coll. Dr. Isert); BOULENGER, Cat., I, 254.

*Plectropoma chloropterum*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., II, 398, 1828, San Domingo; Martinique; POEY, Memorias Cuba, I, 73, tab. 9, fig. 3, 1851.

*Plectropoma monacanthus*, MÜLLER & TROSCHEL, Schomburgk's Hist. Barbadoes, 665, 1847, Barbadoes; GÜNTHER, Cat., I, 164, 1859.

*?Serranus armatus*, OSORIO, Jorn. Sci. Lisboa, 2, III, 1894, 74; fide BOULENGER.

*Alphestes afer*, BLOCH & SCHNEIDER, Syst. Ichth., 1801, 236; PETERS, Berliner Monatsber., 1865, 105 (description of BLOCH's type); JORDAN & SWAIN, *l. c.*, 1884, 396; JORDAN & EIGENMANN, *l. c.*, 350, 1890.

*Prospinus chloropterus*, POEY, Synopsis, 289, 1868.

### 1559. ALPHESTES MULTIGUTTATUS (Günther).

Head 2⅖; depth 2⅘; eye large, 4½ in head. D. XI, 18 to 20; A. III, 9; scales 10–75 to 80–36, pores 55 to 62. Body oblong ovate, compressed.

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* According to Professor Peters, who has examined the type of Bloch in the Museum at Berlin, *Epinephelus afer* of Bloch is, in all respects, identical with *Plectropoma chloropterum*, the types of the two having been compared by him. This may be true, in which case the American species should stand as *Alphestes afer*. It is to be noticed, however, that few species are common to the faunas of Guinea and the West Indies; no one has yet recorded the West Indian species of *Alphestes* from Africa. Bloch distinctly asserts that his specimen was from Arará on the coast of Guinea, whence it was sent by Dr. Isert. The figure of Bloch represents a species deeper in body and more uniformly colored than is our species. The American species should perhaps stand as *Alphestes chloropterus* until its identity with the African one is more clearly shown. On the other hand, it must be admitted that Bloch was often careless as to his statement of localities, and in default of other knowledge, we may accept Peters's identification as sufficient.

Head small, slender, and pointed, the profile nearly straight from the snout to behind the eye, where is formed a considerable angle; the outline thence steeper, but still nearly straight to the front of the dorsal fin. Snout very short, rather pointed, 5½ in head. Mouth small, oblique, the maxillary not reaching to posterior margin of eye, its length 2⅖ in head. Teeth small; small canines present in upper jaw only. Lower jaw rather strongly projecting. Interorbital space very narrow, convex, its width 10 in head. Preopercle strongly convex; the angle not salient, but armed with sharp radiating serræ. A strong flattish spine directed downward and forward below the angle. Nostrils small, round, close together, subequal. Gill rakers moderate, the longest as long as gill fringes, 15 or 16, 14 on lower limb of arch. Scales not very small, mostly cycloid; those on opercles somewhat enlarged. Dorsal spines rather short and stiff, the fourth 3 in head; soft dorsal high; caudal subtruncate, 2 in head; anal rather high, rounded, the longest rays 2 in head; second spine longer and stronger than third, 2⅘ in head; pectorals broad, reaching a little beyond tips of ventrals, 1½ to 1⅔ in head; ventrals shortish, scarcely reaching vent. Color dark olive brown, the body and head profusely covered with round spots of a darker brown, their diameter about half that of the pupil; spots on posterior part of body confluent in horizontal streaks; breast and front of head with few spots; a very faint mustache above maxillary; dorsal and caudal dusky olive, nearly plain; anal with two cross bands of dusky; pectoral yellowish, with 5 dusky cross bands, its edge pale; ventrals dusky. Very close to *A. afer*, differing chiefly in color, the head more slender, the chin more prominent. Length 8 inches. Pacific Coast of tropical America, Mazatlan to Panama; rather common; here described from specimens from Panama. (*multum*, many; *guttatus*, spotted).

*Plectropoma multiguttatum*, GÜNTHER, Proc. Zool. Soc. London, 1866, 600, Panama.

*Plectropoma afrum*, GÜNTHER, Fishes Centr. Amer., 411, 1869, with plate.

*Alphestes multiguttatus*, JORDAN & GILBERT, Bull. U. S. Fish Comm., 1882, 107, 110; JORDAN & EIGENMANN, *l. c.*, 349, 1890.

*Epinephelus multiguttatus*, JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1882, 625; JORDAN & SWAIN, *l. c.*, 1884, 395.

### 504. DERMATOLEPIS, Gill.

*Dermatolepis*, GILL, Proc. Ac. Nat. Sci. Phila., 1861, 54, (*punctatus*).

*Lioperca*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 237, (*inermis*).

Body shorter and deeper than in *Epinephelus*, the head small, much compressed, the interorbital area narrow; supraoccipital crest low; canines very small or obsolete; lower opercular spine absent; frontal bones with the anterior concavity for the reception of the posterior processes of the premaxillaries, and with a process or knob on each side behind the interorbital area; supraoccipital and parietal crests produced on the frontals to between the orbits. Dorsal rays XI, 19; anal III, 9. Soft dorsal very long; anal short; spines low; vertical fins all rounded; scales all cycloid, small, embedded; squamation approaching that of *Rypticus*; canine teeth very small. Otherwise essentially as in *Epinephelus*. Species three, in the warm seas. (δέρμα, skin; λεπίς, scale.)

LIOPERCA (λεῖος, smooth ; πέρκη, perch):

*a.* Preopercle evidently serrate, the serræ rather coarse and blunt; upper jaw with very small canines; pectoral fins long, more than two-thirds length of head, reaching vent; anal spines rather strong; dusky olive, with large rounded whitish spots; no black spots on head; a whitish streak from snout through eye toward front of dorsal. INERMIS, 1560.

DERMATOLEPIS:

*aa.* Preopercle subentire; canine teeth obsolete; pectoral fins short, not two-thirds length of head and not reaching vent; anal spines short; dusky olive, with round whitish spots; head with smaller black spots. PUNCTATUS, 1561.

## Subgenus LIOPERCA, Gill.

### 1560. DERMATOLEPIS INERMIS (Cuvier & Valenciennes).

Head $2\frac{3}{5}$; depth $2\frac{1}{2}$. D. XI, 19; A. III, 9; scales 20–115 to 125–45 to 50, 70 pores. Body comparatively short and deep, strongly compressed, the back elevated, the anterior profile concave, forming a reentrant angle before the eye, thence nearly straight to the nape. Head compressed, the snout short, moderately pointed, $3\frac{2}{3}$ in head. Eye small, $5\frac{3}{4}$ in head. Interorbital space narrow, anteriorly with a broad groove, which receives the spines of the premaxillary bones, its width 8 in head. Posterior part of head narrow, strongly convex transversely. Mouth small, oblique, the jaws subequal, the broad maxillary extending to below the middle of the eye, its length $2\frac{1}{2}$ in head. Supplemental maxillary well developed. Teeth in narrow bands, formed as in *Epinephelus*, but small. Canines scarcely differentiated, none in lower jaw, 1 on each side in upper jaw slightly larger than the other teeth. Preopercle with very weak and irregular serrations, the angle not salient, its teeth little, if any, enlarged. A very slight emargination above the angle. Opercle with a single spine, above which is a flat lobe. Opercular flap unusually large, extending beyond the spine for a distance nearly equal to the diameter of the eye. Gill rakers rather slender, nearly as long as gill fringes, about 14 on lower part of anterior arch. Nostrils round, very close together, the posterior the larger. Scales small, all cycloid, somewhat embedded in the skin; lower jaw scaly; maxillary, preorbital, and tip of snout naked. Dorsal spines strong, the third highest, $2\frac{1}{2}$ in head, the others gradually shorter to the ninth, which is $3\frac{1}{2}$ in head; soft dorsal elevated, the twelfth ray highest, 2 in head; caudal long, rounded in outline, $1\frac{1}{3}$ in head; anal very high, the middle soft rays $1\frac{3}{5}$ in head, the other rays rapidly shortened each way; anal spines short and strong, graduated, the second spine $3\frac{3}{4}$ in head; pectorals very long, nearly reaching anal, $1\frac{1}{5}$ in head; ventrals moderate, $1\frac{5}{7}$ in head, reaching vent or a little farther. Color in alcohol, dusky brown, mottled with darker; head, body, and fins covered with roundish, whitish blotches, which are very irregular in form and size, some of them larger than the eye; the spots most numerous and distinct on the tail and on the lower part of the head; several spots behind the eye, confluent into a pale stripe from eye toward spinous dorsal; fins all blackish, the pale spots smaller and generally less distinct than on body; pectorals olivaceous, with small, rather distinct black spots. West Indies; rare; here described from an

Havana specimen sent by Leonel Plasencia. Length 1 foot. (*inermis*, unarmed.)

*Serranus inermis*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., IX, 436, 1833, **Antilles**; GÜNTHER, Cat., I, 1859, 153.

*Lioperca inermis*, POEY, Synopsis, 282, 1868.

*Dermatolepis inermis*, JORDAN & SWAIN, *l. c.*, 405, 1884; JORDAN & EIGENMANN, *l. c.*, 376, 1890.

*Epinephelus inermis*, BOULENGER, Cat., I, 257.

### Subgenus DERMATOLEPIS.

### 1561. DERMATOLEPIS PUNCTATUS, Gill.

Head $2\frac{9}{10}$; depth $2\frac{2}{5}$; eye small, $6\frac{1}{3}$ in head. D. XI, 19; A. III, 9; scales 24–115–x. Body comparatively short and deep, strongly compressed, the back elevated, the anterior profile forming a slight reentrant angle before the eye, thence nearly straight to the nape. Head compressed, the snout short, moderately pointed, 4 in head. Interorbital space quite narrow, anteriorly with a broad groove, which receives the spines of the premaxillaries, its width $7\frac{1}{2}$ in head. Cranium posteriorly narrow, strongly convex transversely. Mouth rather small, oblique, the jaws subequal, the broad maxillary extending to below the middle of the eye, its length $2\frac{1}{6}$ in head. Supplemental maxillary well developed. Teeth small, formed as in *Epinephelus*, but with no canines in either jaw, not even rudimentary ones. Preopercle not serrated anywhere, its upper part with a few irregular crenations, its angle not salient, its emargination obsolete. Opercle with a rudimentary spine, above which is a flat lobe. Opercular flap extending beyond the spine for a distance nearly equal to the diameter of the eye. Gill rakers shortish, about 13 on lower part of anterior arch. Nostrils small, round, close together, the posterior one the larger. Scales small, cycloid, somewhat embedded in the skin. Maxillary, preorbital, and tip of snout naked. Dorsal spines low, strong, subequal, the longest 4 in head; soft dorsal elevated, the longest ray $2\frac{9}{10}$ in head; caudal long, subtruncate, with rounded angles, $1\frac{3}{4}$ in head; anal very high, rounded, its middle rays $2\frac{1}{4}$ in head; anal spines short and strong, graduated, the second spine 5 in head; pectorals short, not nearly reaching vent, $1\frac{2}{3}$ in head; ventrals short, $2\frac{1}{5}$ in head. Color in spirits, dusky brown, mottled with darker; head, body, and fins covered with rounded whitish blotches, very irregular in form and size, none of them so large as the eye, these spots most distinct on the body; head, breast, and branchiostegals thickly covered with smaller, round, dark spots, very distinct on the jaws and on the membrane of the maxillary; top of head with some dark longitudinal streaks; pectoral with small black spots; other fins blackish, with pale spots like those on the body, but smaller. Rocky shores off the west coast of Mexico; known from Cape San Lucas, the Venados, and the Revillagigedos. About the latter islands, Dr. Gilbert found it in abundance. Description from a specimen 14 inches long (U. S. N. M., No. 28223. Socorro Island. Coll. Captain Nichols). (*punctatus*, spotted.)

*Dermatolepis punctatus*, Gill, Proc Ac. Nat. Sci. Phila., 1861, 54, and 1862, 250, Cape San Lucas, (Coll. Xantus); Jordan & Gilbert, Proc. U. S. Nat. Mus., 229, 1881; Jordan & Swain, *l. c.*, 407, 1884; Jordan & Eigenmann, *l. c.*, 376, 1890.

*Epinephelus dermatolepis*, Boulenger, Cat., I, 256, 1895; name a substitute for *punctatus*, preoccupied in *Epinephelus*.

## 505. MYCTEROPERCA, Gill.

*Mycteroperca*, Gill, Proc. Ac. Nat. Sci. Phila., 1863, 80, (*olfax*).

*Trisotropis*, Gill, Proc. Ac. Nat. Sci. Phila., 1865, 104, (*guttatus* = *venenosus*).

*Parepinephelus*, Bleeker, Systema Percarum Revisum, 257, 1875, (*acutirostris*).

*Archoperca*, Jordan & Evermann, new subgenus, (*boulengeri*).

*Xystroperca*, Jordan & Evermann, new subgenus, (*pardalis*).

Cranium broad and transversely concave between the eyes, its lateral crests very strong, nearly parallel with the supraoccipital crest and extending much farther forward than the latter, joining the supraocular crest above the eye, the supraoccipital crest not extending on the frontals; frontal bones without anterior concavity or notch for the reception of the premaxillaries, without processes on the upper surface; lower jaw strongly projecting; anal fin elongate, with 11 or 12 (in one species 9 or 10) soft rays; caudal lunate; spines of fins slender, none of them much elevated; scales small, mostly cycloid, those on the lateral line simple; pyloric cœca few; gill rakers various; nostrils small, and subequal, or with the posterior enlarged. Otherwise essentially as in *Epinephelus*, from which genus *Mycteroperca* is well separated by the structure of the skull,* and superficially by the longer anal, larger mouth, and more elongate body. Large food-fishes of the tropics, mostly American. (*μυκτήρ*, nostril; *πέρκη*, perch, in allusion to the large divided posterior nostril of *M. olfax*.)

*a.* Nostrils subequal, well separated; scales on head cycloid.
  *b.* Gill rakers comparatively few and short, 8 to 20 below angle of arch.
    Archoperca (ἀρχός, anus; πέρκη, perch; from the high, short anal fin):
      *c.* Anal rays III, 10 (III, 9 to III, 11), the fin high and falcate; body deep, compressed; gill rakers 6 + 15; scales 95; angle of preopercle slightly salient; color olive, with blackish markings; fins dark. BOULENGERI, 1562.
    Trisotropis (τρεῖς, three; ἰσός, equal; τροπίς, keel):
      *cc.* Anal rays III, 11 or III, 12, the fin long.
        *d.* Anal fin not angulated, its outline more or less evenly rounded in adult as well as in young; soft parts of vertical fins edged with black in life.
          *e.* Angle of preopercle not salient, its teeth scarcely enlarged; gill rakers x + 8 to 10.
            *f.* Gill rakers very few and short, x + 8 developed (besides some rudiments); general color pale, bright red, or grayish, with roundish spots or blotches of black or red darker than the ground color; the blacker blotches along the middle of sides much larger and quadrate in the young; red always present somewhere in life (fading in spirits); pectorals blackish, in the adult broadly tipped with orange yellow; scales rather small (about 125); caudal lunate. VENENOSA, 1563.

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*This character is thus expressed by Dr. Gill: "The skull differs from that of *Epinephelus* by the wider interorbital area; the parallelism and continuation of the lateral crests forward to the middle of the orbits, inclosing an elongated parallelogram, the surface of which, especially between the orbits, is more uniform; the absence of a frontal crest, the simple curvature or straightness of the naso-vomerine ridge, and absence of the angle at the suture between the nasals and the vomer."

*y.* General color gray, with red and black markings. (var. *venenosa*).

*yy.* General color scarlet, with red and black markings. APUA, 1563*a*.

*ff.* Gill rakers rather slender, about x + 10 (besides several rudiments); caudal subtruncate; nostrils small.

*g.* Scales not very small (about 110); color dark olive green; sides of head and body with rivulations of dark bluish around roundish dark-bronze spots, large or small (these markings subject to considerable variation, fading in spirits); sides with darker quadrate areas.

*z.* Dark blotches on body rather large, often quadrate. BONACI, 1564.

*zz.* Dark spots on body very small, close-set, of a deep bronze orange. XANTHOSTICTA, 1564*a*.

*gg.* Scales small (120 to 140); angle of preopercle not salient, but the teeth at the angle somewhat larger; general form, appearance, and color of *M. bonaci.* Color olive green; head with numerous dark-green streaks radiating from eye; a dark mustache along maxillary; body with small, irregular, dark, quadrate blotches; fins, except pectorals, mostly dusky. JORDANI, 1565.

*ee.* Angle of preopercle more or less salient, its teeth somewhat enlarged; gill rakers more numerous, x + 12 to 14.

*h.* Scales very small (about 140); caudal peduncle without black spot; interorbital area scarcely concave; cheeks without distinct dusky stripes; commissure without yellow; caudal distinctly lunate; gill rakers few, about 12 on lower part of anterior arch. MICROLEPIS, 1566.

*hh.* Scales rather small (about 120); interorbital area channeled; angle of preopercle little salient; body slender; caudal little concave; sides with small, faint spots of darker; commissure with yellow green. INTERSTITIALIS, 1567.

*hhh.* Scales not very small (about 110); upper part of body dark brown, the lower half abruptly paler; a pale ring around the caudal peduncle, behind which is a squarish dark blotch, smaller than eye, at base of upper rays of caudal; caudal deeply lunate; teeth strong. DIMIDIATA, 1568.

*dd.* Anal fin angulated, its middle rays much exserted, its posterior margin concave; body rather robust; scales moderate (about 110); caudal fin subtruncate; gill rakers about x + 18; angle of preopercle slightly salient, with coarser teeth; seventh ray of anal nearly half head; tenth ray of dorsal somewhat produced; color nearly plain dark olivaceous, the edges of the fins scarcely darker. XENARCHA, 1569.

PAREPINEPHELUS (παρά, near; *Epinephelus*):

*bb.* Gill rakers close-set, very long and slender, 25 to 35 below angle of arch.

*i.* Caudal fin lunate, its angles more or less produced in the adult, the fin subtruncate in the young; anal fin more or less angulate in the adult, rounded in the young; soft dorsal somewhat angular; scales rather large (lateral line 95); body rather deep, the snout sharp; preopercle with a salient angle which is armed with larger teeth; dorsal spines low; gill rakers close-set, x + 30, the longest 7½ in head; ventrals not reaching to vent; color olive gray, with darker reticulations around pale spots; fins not much darker on their edges; a dark mustache along the maxillary; adult examples nearly uniform brown; not known to be red. RUBRA, 1570.

*aa.* Nostrils very close together, the posterior decidedly larger than the anterior, and with a more or less distinct horizontal cross septum within; scales on head cycloid.

XYSTROPERCA (ξύστρον, a raker; περκη, perch):

*j.* Gill rakers very numerous, long and slender, about 24 below angle of arch; fourth dorsal spine highest; soft dorsal and anal high, but scarcely falcate. Color greenish, with many round brown spots. PARDALIS, 1571.

MYCTEROPERCA:

*jj.* Gill rakers moderate, fewer in number, 6 to 18 below angle of arch.

*k.* Second dorsal spine highest, its length more than $\frac{1}{3}$ that of head; third spine scarcely shorter; caudal slightly lunate; canine teeth moderate; angle of preopercle not salient; anal fin angulated, its longest rays about $2\frac{1}{3}$ in head, its posterior margin concave; gill rakers coarse and long, x + 15; scales small (13-20-x).

*x.* Color brown, with grayish reticulations around brown spots; fins dusky-edged. OLFAX, 1572.

*xx.* Color chiefly red. RUBERRIMA, 1572*a*.

*kk.* Second dorsal spine low, shorter than third, the third and fourth highest.

*l.* Margin of anal fin posteriorly concave, its middle rays much exserted.

*m.* Gill rakers rather numerous, 17 to 20 below angle of arch.

*n.* Outer rays of caudal scarcely produced, not $\frac{2}{3}$ length of head; canine teeth moderate; angle of preopercle little salient; scales small (about 130); color plain red; vertical fins without black edgings; gill rakers long, x + 17. ROSACEA, 1573.

*nn.* Outer rays of caudal much produced, more than $\frac{2}{3}$ length of head; preopercle with salient angle; canine teeth strong; scales small (140); gill rakers about 4 + 20. Color brownish, with small darker spots; vertical fins broadly edged with blackish.

*x.* Upper canines directed strongly forward, the lower backward; coloration obscure. FALCATA, 1574.

*xx.* Upper canines nearly vertical; coloration paler and brighter. PHENAX, 1574*a*.

*mm.* Gill rakers few, 8 below angle of arch; caudal well forked, the outer rays $1\frac{3}{4}$ in head; preopercle without salient angle. Color uniform olive brown, the vertical fins dark-edged. Size very large. VENADORUM, 1575.

*ll.* Margin of anal fin not concave posteriorly, the outline of the fin rounded or slightly angular.

*o.* Gill rakers rather few, x + 12; body without dark cross bars, covered with grayish reticulations around small round spots, these not evident on head; anal fin rounded; preopercle with a salient angle; caudal deeply lunate; scales moderate (lateral line 90 to 100); form rather robust; anal fin not angulate. CALLIURA, 1576.

*oo.* Gill rakers very few, short, and thick, about x + 6; body olive or (var. *camelopardalis*) bright red, with light and dark cross bars, these often becoming obsolete with age; head usually with distinct reticulations around yellowish spots; anal fin with angular margin, subtruncate posteriorly; preopercle without salient angle; scales rather small (lateral line 133); form rather robust.

*x.* Ground color dark olive. TIGRIS, 1577.

*xx.* Ground color bright red. CAMELOPARDALIS, 1577*a*.

### Subgenus ARCHOPERCA, Jordan & Evermann.

### 1562. MYCTEROPERCA BOULENGERI, Jordan & Starks.

(CABRILLA DE RAIZERO; MANGROVE GROUPER.)

Head $2\frac{4}{5}$ to $2\frac{5}{6}$ in length; depth $2\frac{5}{6}$ to 3. Dorsal XI, 15 (14 to 16); anal III, 9 to III, 11; scales about 19-90 to 95-38; snout $3\frac{1}{2}$ in head; maxillary $2\frac{1}{5}$; eye $5\frac{1}{2}$; pectoral $1\frac{3}{4}$; ventral $1\frac{5}{6}$; anal ray $1\frac{2}{3}$; caudal $1\frac{3}{5}$. Longest dorsal spine $2\frac{1}{2}$. Gill rakers short, about 6 + 17, the longest about $\frac{3}{5}$ in eye. Longest dorsal ray 2. Body short and deep, compressed. Head moderate, compressed, its profile not steep, nearly straight, a depression before eye. Upper canines moderate, scarcely differentiated, the lower quite small. Teeth in 2 irregular rows laterally, a larger number in front. Nostrils small, well separated, the anterior slightly larger. Lower jaw very strongly projecting. Maxillary reaching opposite posterior edge of pupil, or a little farther. Preopercle slightly notched, the angle slightly salient, with somewhat enlarged teeth, the serrations all weak. Dorsal scarcely notched, the fourth spine not elevated, the spines all subequal except the first. Second dorsal high and long, its median rays forming a conspicuous angle, its posterior border somewhat concave, rounded. Caudal scarcely lunate, the upper lobe slightly exserted, the lower truncate. Anal very high, strongly falcate, its posterior border incised, the anterior rounded. Pectoral and ventral moderate, almost coterminous. Anal spines graduated. Scales smoothish, not very small. Color: Olive gray, covered everywhere with oblong, irregular markings of black, between which the ground color forms rivulations; color of adults fainter, with smaller spots; gray lines radiating from the eye; a blackish blotch behind maxillary; pectoral olive yellow; other fins blackish, clouded with pale; first dorsal with faint, small, black spots; caudal with a very narrow, pale margin; none on other fins. Length 15 inches. A small species, rather common in the astillero or estuary at Mazatlan, with *Mycteroperca jordani*, which it much resembles in color, differing in form and in the short, high anal. This species has the coloration and form of *Mycteroperca*, with a short anal fin, scarcely longer than in *Epinephelus*. The character of the skull is somewhat intermediate, but on the whole nearest *Mycteroperca*. The supraoccipital and parietal crests are high, the former extending forward to the posterior margin of the orbit; parietal crests parallel with each, and extending forward to pupil; interorbital space concave. (Named for Dr. George Albert Boulenger, the accomplished ichthyologist of the British Museum, in recognition of his admirable work on the *Serranidæ*, in the Catalogue of Teleostean Fishes.)

*Mycteroperca boulengeri*, JORDAN & STARKS, Fishes of Sinaloa, in Proc. Cal. Ac. Sci., 1895, 445, pl. 38, Mazatlan. (Type, No. 47481. Coll. Hopkins Expedition to Mazatlan.)

### Subgenus TRISOTROPIS, Gill.

### 1563. MYCTEROPERCA VENENOSA (Linnæus).

(ROCKFISH; YELLOW-FINNED GROUPER; BONACÍ DE PIEDRA.)

Head 2⅗ (3½); depth 3 (3⅘); eye small, 7 in head (adult). D. XI, 16; A. III, 11; scales 24–125–x. Body rather robust, not strongly compressed; head rather bluntish, its anterior profile a little uneven. Mouth large, the maxillary reaching much beyond eye, 2 in head; teeth in rather narrow bands, each jaw with 2 strong canines, which are not directed forward; nostrils moderate, close together, the posterior largest. Interorbital space flat, broad, 5 in head. Preopercle without salient angle, its emargination slight. Scales rather small, chiefly cycloid. Dorsal spines not very weak, the outline of the fin gently convex, the second spine about as long as tenth, the highest 3 in head; caudal fin lunate, the inner rays 1⅓ in outer, which are 1½ in head; anal rounded, rather low, the longest rays 2½ in head; pectorals reaching well beyond tips of ventrals, 2 in head. Pyloric cœca 15 to 20 (Poey.) Color in life (adult): Clear olive green, livid bluish or pearly below (grayish below in spirits); upper parts marked everywhere with broad reticulations, and curved blotches of bright, clear light green; these reticulations most distinct on the upper part of the head; a greenish blotch on shoulder before dorsal; entire body and head covered with round orange-brown spots (becoming brown in spirits) about as large as the nostrils, the centers darkest; these spots largest and least numerous above; angle of mouth orange within; iris orange; breast slightly rosy, grayish in spirits; dorsal olive brown, with whitish blotches and a very few dark spots; soft dorsal, anal, caudal, and ventrals broadly edged with blackish, the caudal with more spots, these fins otherwise colored like the dorsal fin; pectoral olivaceous, its tip yellow, its base spotted. Length 3 feet. Bahamas, Florida Keys, and southward; generally common in rocky places; here described from a specimen from Key West. (*venenosus*, venemous, the flesh being sometimes poisonous.)

*Perca marina venenosa*, the Rockfish, CATESBY, Nat. Hist. Fishes Carolina, etc., II, tab. 5, 1743, Bahamas.
*Perca venenosa*, LINNÆUS, Syst. Nat., Ed. x, 1758, 292, Bahamas; after CATESBY.
*Serranus petrosus*, POEY, Memorias, II, 136, 1860, Havana.
*Mycteroperca venenosa*, JORDAN & SWAIN, *l. c.*, 373, 1884; JORDAN & EIGENMANN, *l. c.*, 369, 1890.
*Trisotropis petrosus*, JORDAN & GILBERT, Synopsis, 918, 1883.
*Epinephelus venenosus*, BOULENGER, Cat., I, 259.

Represented in deep water by the red form or subspecies

### 1563a. MYCTEROPERCA VENENOSA APUA (Bloch).

(BONACI CARDENAL.)

Head 2⅔; depth 3; eye small, 5½ in head (young). D. XI, 16; A. III, 11; scales 24–121–x. Body rather short and deep, rather strongly compressed. Head rather bluntish, the anterior profile rather strongly and regularly arched; mouth rather large, the maxillary reaching past the eye, 2⅓ in head (in young). Lower jaw projecting, but rather less prominent than usual in *Mycteroperca*. Teeth moderate, in rather narrow bands; both jaws with 2 moderate canines in front, the upper larger and not directed forward. Nostrils close together, subequal. Interorbital space flattish or slightly concave, its width 6 in head. Preopercle without salient angle, its emargination very slight, the teeth below the notch slightly enlarged. Scales rather small, chiefly cycloid. Dorsal spines not very slender, the second spine as long as tenth; the third and fourth highest, 3⅙ in head; caudal fin slightly lunate, the outer rays a little longer than inner, 1⅖ in head; anal rather high, somewhat rounded, the longest rays 1⅚ in head; pectorals about reaching tips of ventrals, 1¾ in head. The color varies much with age and probably also with the depth of water:

(*a*) Color in life of an adult example about 2½ feet in length: Very dark everywhere, sparsely covered with round spots, which are black on the body and red on the belly; mouth red within; pectoral broadly edged with orange red, otherwise plain; no other bright colors anywhere; soft parts of vertical fins largely black.

(*b*) Color in life of an example about 2 feet in length: Intense scarlet red above, grayer below; above, small black spots; below, larger red ones; base of dorsal and caudal deep red; edge of dorsal, caudal, and anal black; pectoral spotted at base, then blackish, thence broadly yellow.

(*c*) Color in life of specimens 8 inches in length: Scarlet brown above, the color varying from vermilion to gray, becoming grayish in spirits; sides light gray; the ground color forming rivulations around quadrate blotches of black; belly and lower part of head scarlet; blotches above and on sides black; the upper ocellated with red; those on sides, below lateral line, presenting the appearance of interrupted horizontal bands; the blotches below all vermilion, separated by rivulations of ground color; lower jaw yellowish, with red blotches; pectorals yellow; the fins otherwise all marbled with red and black; the vertical fins with grayish rivulations, edged with black and tipped with white. In spirits the scarlet and red above become gray, the vermilion below, whitish. With age the large quadrate blotches on the sides and below gradually break up into smaller spots, and in time the coloration of *a* and *b* is reached. West Indies, Florida Keys, and southward to Brazil, in deeper water than the true *venenosus*, from which only the color separates it. Whether this and similar color forms should be regarded as subspecies, as distinct species, or should be totally ignored in systematic literature is a question not easily settled. For the present we let them stand as subspecies, but do not regard this view of the case as satisfactory. We have never seen a specimen intermediate between *apua* and *venenosa*, nor can any doubt exist in the determination of specimens. (*Apua* or *Apia*, a Brazilian name; *Pirati apia*, according to Marcgrave.)

*Pirati apia*, Marcgrave, Hist. Brasil, 1648, 158, Brazil.

*Bodianus apua*, Bloch, Ichth., VII, 37, taf. 229, 1790, Brazil (after a drawing by Prince Maurice of Nassau—the same used by Marcgrave).

*Bonací cardenal*, Parra, Piezas de Hist. Nat. Cuba, 29, pl. XVI, 1787, Havana,

*Johnius guttatus*, Bloch & Schneider, Syst. Ichthyol., 77, 1801 (after Parra).

*Bodianus marginatus*, Bloch & Schneider, *l. c.*, 331 (after Marcgrave).

*Serranus cardinalis*, Cuvier & Valenciennes, Hist. Nat. Poiss., II, 378, 1828 (after Parra).

*Serranus rupestris*, Cuvier & Valenciennes, Hist. Nat. Poiss., IX, 437, 1833, San Domingo; Günther, Cat., I, 145, 1859.

*Trisotropis cardinalis*, Poey, Enumeratio, 13, 1875.

*Mycteroperca venenosa guttata*, Jordan & Swain, Proc. U. S. Nat. Mus., 1884, 375.

*Mycteroperca venenosa apua*, Jordan & Eigenmann, *l. c.*, 370, 1890.

### 1564. MYCTEROPERCA BONACI (Poey).

(Bonací Arará; Black Grouper; Aguaji.)

Head 2¾; depth 3¼; eye moderate, 6 in head (young). D. XI, 16 to 18; A. III, 11 or 12; scales 18–120 to 125-50, pores 70 to 85. Body comparatively slender, a little more robust than in *M. microlepis*, its breadth 2⅓ in its depth; head moderate, rather pointed, its anterior profile little curved;

mouth rather large, the maxillary reaching slightly beyond eye, $2\frac{1}{5}$ in head (in young), proportionately longer in adult; maxillary with cycloid scales. Teeth in rather narrow bands; two rather strong canines directed little forward in front of each jaw. Interorbital space slightly convex, its width 6 in head. Preopercle forming a regular curve without salient angle, the emargination near the angle very slight. Nostrils small, roundish, subequal; not very close together. Gill rakers few and long, 10 to 12 besides rudiments on lower part of anterior arch. Scales rather small, chiefly cycloid; dorsal spines comparatively slender and weak, the outline of the fin gently convex; the tenth spine about as long as second; third and fourth spines longest, $3\frac{1}{3}$ in head; caudal fin truncate when spread open, its outer rays a very little produced, $1\frac{3}{5}$ in head; anal rather high and rounded, its longest rays $2\frac{1}{4}$ in head; pectoral reaching slightly beyond tips of ventrals, $1\frac{7}{10}$ in head. Ventrals short, not reaching vent. Pyloric cæca 15. Color in life, deep orange brown, more olive on the back, clouded above by paler or grayish; sides and belly marked everywhere by reticulations of pearly gray, which surround roundish or oblong spots of the ground color, the pale streaks being largely horizontal on the sides; sides of the head similarly marked, the spots smaller, bronze brown, the reticulations decidedly bluish; 6 or 7 spots in a straight line between eye and preopercle, the spots having nearly the diameter of the pupil; spots on the body mostly covering 4 to 6 scales, all of them larger than a scale; dorsal olive brown, somewhat mottled; caudal similar to dorsal, narrowly edged with whitish; anal similar, with 2 or 3 rows of bluish spots, its tips blackish, with a narrow whitish edge; pectorals olive brown, plain; ventrals blackish, the rays bluish. Mouth not green, the lips olive, barred with bluish; iris reddish. Here described from a specimen $11\frac{1}{2}$ inches long, from Key West. A large specimen, about $2\frac{1}{2}$ feet in length, seen at Key West, retained the same general coloration, the bronze spots and rivulations being distinct and not smaller than in the young. In spirits the orange brown of the body is replaced by dark brown, and the blue reticulations of the head, by gray; all the markings become more faint. Length 2 to 3 feet; maximum weight 50 pounds. West Indies, Pensacola to Brazil; abundant about Key West, where it is known as Black Grouper, being the only species to which that name is applied. The young are taken along the shore in the seine. The species is equally common at Havana. (*Bonací*, the Cuban name for the species.)

*Serranus bonaci*, POEY, Memorias, II, 129, 1860, Cuba.
*Serranus brunneus*, POEY, Memorias, II, 131, 1860, Havana.
*Serranus arará*, POEY, Memorias, II, 132, 1860; not of CUVIER & VALENCIENNES.
*Serranus decimalis*, POEY, Memorias, II, 138, 1860, Cuba; specimen with 10 dorsal spines.
*Trisotropis aguaji*, POEY, Repertorio, II, 229, 1868, Havana.
*Serranus cyclopomatus*, POEY, Memorias, II, 353, 1861, Cuba.
*Serranus latepictus*, POEY, Memorias, II, 353, 1861, Cuba.
*Trisotropis bonaci*, POEY, Synopsis, 283, 1868.
*Epinephelus bonaci*, JORDAN, Proc. U. S. Nat. Mus., 1884, 124; BOULENGER, Cat., I, 265.
*Mycteroperca bonaci*, JORDAN & SWAIN, *l. c.*, 1884, 370; JORDAN & EIGENMANN, *l. c.*, 370, 1890.
*Trisotropis brunneus*, POEY, Synopsis, 1868, 284; JORDAN & GILBERT, Synopsis, 1883, 538.

Represented in deeper water off Florida by

### 1564a. MYCTEROPERCA BONACI XANTHOSTICTA, Jordan & Swain.

Head 3; depth 3; eye 9⅓ in head (adult). D. XI, 17; A. III, 12; scales 22–110–x. Body comparatively robust, formed much as in *M. venenosa.* Head large, its anterior profile little curved, the snout not very acute, 3⅔ in head. Mouth large, the maxillary reaching to beyond eye, $1\frac{9}{10}$ in head (in adult). Teeth in moderate bands; 2 strong, nearly vertical canines in front of each jaw. Interorbital space strongly convex, its breadth 4½ in head. Preopercle forming a regular curve, without salient angle, the emargination near its angle very slight. Nostrils roundish, close together, subequal. Scales rather small, chiefly cycloid. Dorsal spines rather slender and low, the third spine 3⅗ in head; caudal fin subtruncate when spread open, its outer rays very slightly produced, 1⅞ in head; the rays of the fin projecting slightly beyond the membranes; anal high and rounded, its longest rays 2⅘ in head; pectoral reaching slightly beyond tips of ventrals $2\frac{2}{7}$ in head. Color of fresh specimen, rather bright dark purplish gray, scarcely paler below, rather darkest along top of head and sides of back; chin dark; a few obscure paler rivulations on belly, sides, and especially on breast; head and body everywhere covered very evenly with round, close-set spots of a bright bronze orange; these spots mostly broader than the interspaces, and with an average diameter about equal to that of a nostril, obscure on lower part of head and body, but traces of such spots almost everywhere; spots most distinct on head, and covering the dark part of the eye; on the lower jaw the spots are oblong and more closely set; about 23 spots in a straight line from eye to angle of preopercle; spots on the body usually arranged one to each scale, the average diameter being considerably less than that of a scale, none on body as large as the scale; bases of pectoral, anal, and caudal similarly spotted; dorsal dark olive brown, the distal half of the soft dorsal black; caudal and anal colored like the soft dorsal, the black on the caudal paler, the latter without the narrow pale edge of the dorsal and anal; pectorals and ventrals brownish, blackish toward the tips, the pectoral with a grayish edge and no yellow; a dusky mustache on preorbital, along edge of maxillary; membrane of region concealed by maxillary covered with very bright orange spots; angle of mouth on lower jaw largely yellowish green, with some dull orange Length 4 feet. Snapper Banks off Pensacola; scarce. (ξανθός, yellow; στικτός, spotted.)

*Mycteroperca bonaci xanthosticta*, Jordan & Swain, Proc. U. S. Nat. Mus., 1884, 371, Pensacola, (Coll. Jordan & Stearns); Jordan & Eigenmann, *l. c.*, 370, 1890.

### 1565. MYCTEROPERCA JORDANI (Jenkins & Evermann).

(Cabrilla de Astillero; Baya.)

Head 2⅔ to 2¾; depth 3⅕ to 3¾; eye 6½ to 7½ in head; snout 3¼ to 3⅔. D. XI, 16 or 17; A. III, 11; scales 20–120 to 135–43; maxillary 2⅓; pectoral 1¾ to 1⅘; ventral 2 to 2⅕; fourth dorsal spine 2⅗ to 3; soft dorsal rays 2⅗ to 2¾; longest anal ray 2⅕; caudal lobes 1¾ to 1⅘ in head; gill rakers 3 + 10 or 11, short, the longest barely longer than pupil. Body moderately elongate, compressed. Head low, large, profile anteriorly a little convex, depressed before eye. Mouth moderate, the lower jaw very prominent; canines in both jaws rather strong. Nostrils well separated, subequal. Preopercle scarcely notched, the angle not salient; the teeth at angle scarcely enlarged. First dorsal low, scarcely notched, the fourth spine not elongate. Soft dorsal moderate, rounded; caudal truncate or very slightly rounded, becoming concave with age; anal high, anteriorly rounded, not falcate but with a sharp angle, its posterior border not incised; second anal spine shorter than third, 6 in head. Pectorals moderate; ventrals shortish. Color olive gray, blackish above, with obscure clouds of darker olive in the form of diffuse dark blotches, these oblong, quadrate, and arranged in 4 series; lower parts pale olive; sides of head with wavy blackish streaks; a black mustache behind maxillary; lower side of head clouded; lower lip greenish, inside of mouth pale; pectorals reddish green, without pale edge; other fins blackish, the soft dorsal and caudal narrowly edged with whitish; a little dull red on lower edge of anal and caudal.* Length 2 to 3 feet. Gulf of California; common in bays and sheltered waters; not seen about rocks; here described from specimens from Mazatlan; a food-fish of importance at Guaymas and Mazatlan. (Named for David Starr Jordan.)

*Epinephelus jordani*, JENKINS & EVERMANN, Proc. U. S. Nat. Mus.. 1888, 140, Guaymas, (Type, No. 39628. Coll. Jenkins & Evermann); BOULENGER,† Cat., I, 263.

*Mycteroperca jordani*, JORDAN & EIGENMANN, *l. c.*, 371, 1890; EVERMANN & JENKINS, Proc. U. S. Nat. Mus., 1891, 143, pl. I, fig. 2.

### 1566. MYCTEROPERCA MICROLEPIS (Goode & Bean).

(GAG; AGUAJÍ.)

Head 2⅗; depth 3½; eye moderate, 6½ in head (young). D. XI, 16 to 19; A. III, 11; scales 24–140 to 145–50 to 60, pores 88 to 95. Body comparatively elongate, compressed, its greatest width 2¼ in greatest depth.

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* The following is the original description of this species, slightly condensed: Head 2.6 in body to base of caudal (3.1 in total); depth 3.6 in body; depth of caudal peduncle 8.8; dorsal XI, 17; anal III, 11; scales very small, crowded, about 20–160–40. Body comparatively elongate, compressed. Head long, lower jaw protruding, maxillary extending but slightly beyond the eye in the smaller specimens and not at all in the larger ones; eye 7.2 in head, the interorbital space 6 in head. Preopercle slightly emarginate above the angle and on lower limb below the angle; the serræ above the angle very fine, at the angle stronger, the lower limb entire. Nostrils not very near together. Distance between them 8 in longer diameter of eye; the anterior circular, with a flap; posterior elliptical and not more than twice the diameter of the anterior. Gill rakers of anterior arch rather short, the longest about 2 in eye; about 9 developed and 2 rudimentary ones on lower branch, one in the angle, 2 well developed on upper branch, with a few others rudimentary. Teeth on lower jaw in about 2 series, laterally strong; on upper jaw several strong teeth intermingled with many small ones; two prominent canines in each jaw. Caudal fin very slightly lunate, the outer rays scarcely longer than inner, 2 in head; pectorals reaching beyond the tip of ventrals, 5 in body and 1.9 in head; ventral fin shorter than the pectoral, 6.25 in the body, its spine 4 in head; the first 3 spines of the dorsal graduated, the first 8.8, the second 4.26, the third 3.3, in head; the tenth spine 4, and the eleventh 3.8, in head. The longest soft ray, the sixth, 2.3 in head; origin of dorsal a little less than length of head from tip of snout; anal spines graduated, the first 14.4, the second 6.4, the third 5.2, in head, the fin evenly rounded, the longest soft ray 2.3, and the last 4.8, in head. Color in alcohol, much as in *E. bonaci*, Poey, brown, with irregular darker mottlings of considerable size, but varying much; belly paler; dorsal and anal fins of the general color of the body, the anal having the lower edge pale, the outer margin not evidently darker; ventrals black with the tip white; pectorals paler.

† By error credited by Dr. Boulenger to Jordan & Evermann, instead of to Jenkins & Evermann.

Head long, rather pointed, compressed, its anterior profile comparatively evenly curved and not much arched; mouth comparatively large, the maxillary extending (in the young a foot long) slightly beyond the eye, its length 2⅕ in head. In the adult the maxillary is proportionately longer, about half head; teeth in rather narrow bands; each jaw with two canines, the upper rather large and directed little forward, the lower rather small. Interorbital space slightly convex, 7 in head. Gill rakers few, about 12 on lower part of anterior arch. Preopercle with a shallow emargination above the angle, which is somewhat salient and armed with radiating serræ considerably larger than those on the upper limb, which are very fine. Nostrils small, rounded, subequal, not very close together. Scales very small, chiefly cycloid. Dorsal spines comparatively slender and weak, the outline of the fin gently convex; the tenth spine about as long as second; third and fourth spines longest, 3½ in head: caudal distinctly lunate, the outer rays ⅕ longer than the inner, 1¾ in head; anal rather high, its posterior margin convex, the longest ray 2⅓ in head, the spines small, graduated; pectoral reaching slightly beyond tips of ventrals, 2 in head. Shade of color variable, those found in shallow water being lighter and more variegated. Specimens from deep water are plain brownish gray, paler below, with no distinct spots or rivulations, but faint traces of darker spotting, which disappear in spirits, a faint mustache; lips not green; dorsal dark olive, the tip of soft part blue black, its edge narrowly white; caudal black, with bright-blue shadings, its edge white; anal deep indigo blue, olive at base, its edge white; pectorals olive, dusky toward the tip; ventrals blackish, the first ray tipped with white. Specimens taken in shallow water among grass are green olive, mottled with darker green, and variously clouded, but without spots or rivulations; mustache black; fins colored as above, distinctly bluish; radiating streaks of bluish from eye; all the blue markings of life fade more or less into dusky or grayish in spirits. Length 2 to 3 feet. South Atlantic and Gulf Coast of United States, north to Beaufort, North Carolina, and Pensacola; not known from the West Indies. This species ranges farther north on our coasts than any other of the *Epinephelinæ* except *Epinephelus morio*. It reaches a weight of about 50 pounds. Along the coast of Florida it is generally abundant on the banks and reefs, and is an important food-fish. (*μικρός*, small; *λεπίς*, scale.)

*Trisotropis microlepis*, Goode & Bean, Proc. U. S. Nat. Mus., 1879, 141, West Florida, (Type, Nos. 5137*a*; 5137*b*. Coll. Kaiser & Martin); Jordan & Gilbert, Synopsis, 538, 1883.

*Trisotropis stomias*, Goode & Bean, Proc. U. S. Nat. Mus., 1882, 427, Pensacola; Key West, (Type, Nos. 21336, 26561, 26587. Coll. Stearns); Jordan & Gilbert, Synopsis, 918, 971.

*Epinephelus microlepis*, Jordan, Proc. U. S. Nat. Mus., 1884, 124; Boulenger, Cat., I, 260.

*Mycteroperca microlepis*, Jordan & Swain, *l. c.*, 367, 1884; Jordan & Eigenmann, *l. c.*, 371, 1890.

### 1567. MYCTEROPERCA INTERSTITIALIS (Poey).

Head 2⅔; depth 3½; eye large, 5½ in head. D. XI, 16 or 17; A. III, 12; scales 20–120–x. Body more slender than in any other of the species here described; its greatest width half its greatest depth; head not very acute, the anterior profile rather strongly curved, somewhat gibbous above the eyes: mouth moderate, the maxillary reaching slightly beyond eye, 2¼ in head; teeth in narrow bands; 2 strong canines in the front of each jaw, those of the upper jaw nearly vertical: nostrils rather small, subequal, nearly round; interorbital space slightly concave, its width 5½ in head; the orbital ridges elevated. Preopercle with a moderate emargination, its angle a little salient, with slightly coarser teeth; gill rakers rather few, about 17 on lower part of anterior arch. Scales rather small, chiefly cycloid. Dorsal spines rather slender and weak, the outline of the fin gently convex: the second spine slightly longer than the tenth, the third and fourth longest, 3⅓ in head; anal rather high, posteriorly rounded, 2 in head; caudal fin a little concave, the inner rays 1⅕ in outer, which are 1⅗ in head; pectorals reaching tips of ventrals, 2 in head. Pyloric cœca 12 (Poey.) Color of body in spirits, dark brown, in life with small darker spots, surrounded by reticulations of the ground color: dorsal and caudal fins dusky, their margins blackish: anal dusky, edged with bluish black; ventrals dusky, edged with bluish black, the rays lighter: pectorals dusky, a well-defined mustache above the maxillary; fins edged with dull orange in life, this color disappearing in spirits. Length about a foot. Coasts of Cuba: rather common in the markets of Havana, where the specimens here described were taken by Dr. Jordan. (*interstitialis*, having interstices.)

*Serranus interstitialis*, POEY, Memorias, II, 127, 1860, Cuba.
*Trisotropis chlorostomus*, POEY, Repertorio, II, 231, 1868, Cuba.
*Trisotropis interstitialis*, POEY, Synopsis, 285, 1868.
*Mycteroperca interstitialis*, JORDAN & SWAIN, *l. c.*, 365, 1884: JORDAN & EIGENMANN, *l. c.*, 371, 1890.
*Epinephelus interstitialis*, BOULENGER, Cat., I, 266.

### 1568. MYCTEROPERCA DIMIDIATA (Poey).

Head 3; depth 3. D. XI, 16; A. III, 11; scales 110. Body rather deep and compressed; mouth small, lower jaw projecting; canines strong, as in *Mycteroperca falcata*: snout rather sharp, 4 in head; maxillary 2; eye 5; nostrils small, not far apart, the anterior rather the larger; angle of preopercle salient, armed with stronger teeth; gill rakers rather slender, x + 14. Scales rather small; caudal fin rather deeply lunate; anal fin rounded. Color in spirits, quite dark above, the lower half abruptly paler; a narrow, pale ring around caudal peduncle, behind which is a squarish dark blotch, smaller than eye, at base of upper rays of caudal; a dark area from tip of lower jaw through eye to the boundary between the dark and pale on the sides; caudal, soft dorsal, ventrals, and anal edged with black. Here described from a small specimen (26953, M. C. Z., 8 inches long) in the Museum at Cambridge, sent from Havana by Professor Poey, and probably one of his types. Coasts of Cuba; apparently very rare. (*dimidiatus*, halved, upper half of body differing in coloration from lower.)

*Serranus dimidiatus*, POEY, Memorias, II, 129, 1860, Cuba.
*Trisotropis dimidiatus*, POEY, Synopsis, 285, 1868.
*Mycteroperca dimidiata*, JORDAN & SWAIN, *l. c.*, 367, 1884; JORDAN & EIGENMANN, *l. c.*, 372, 1890.
*Epinephelus dimidiatus*, BOULENGER, Cat., I, 264.

### 1569. MYCTEROPERCA XENARCHA, Jordan.

Head $2\frac{2}{3}$; depth 3; eye small, 7 in head. D. XI, 16; A. III, 11; scales 25–110 to 115–50. Body rather deep and compressed; head compressed, with rather short, sharp snout, which is 4 in head; profile steep and nearly straight; mouth large, the maxillary reaching scarcely beyond eye, 2 in head; lower canines small; upper canines (2 in number) strong, scarcely directed forward; preorbital narrow, $\frac{3}{4}$ width of eye; interorbital area convex, its width $4\frac{1}{2}$ in head; nostrils small, the posterior scarcely the larger, separated from the anterior by one diameter; angle of preopercle scarcely salient, but provided with coarser teeth; a rather sharp notch above it; opercular spine flat and divided into about 6 teeth at the end; gill rakers moderate, 9 + 18; scales moderate, scarcely ctenoid; dorsal spines low, the outline of the spinous dorsal gently convex, the fourth spine longest, 3 in head; soft dorsal high, its outline angular, the tenth ray produced, $1\frac{5}{6}$ in head; anal fin formed as in *Mycteroperca falcata*, its seventh ray produced and falcate, $1\frac{4}{5}$ in head, its posterior outline concave; caudal subtruncate, the outer slightly produced; pectoral $1\frac{3}{4}$ in head. Color in spirits plain dark olivaceous, the edges of the fins scarcely darker. Rocky Islands of the eastern Pacific from Mazatlan to the coast of Peru; known from numerous specimens in the Museum of Comparative Zoology at Cambridge, from the Galapagos Islands, and from Payta, Peru. The above description is from a specimen 22 inches long, taken by us at the Venados Islands, near Mazatlan. This is larger than the original types of the species. (*ξενός*, strange; *ἀρχός*, anus.)

*Mycteroperca xenarcha*, JORDAN, Proc. Ac. Nat. Sci. Phila., 1887, 387, James Island, Galapagos (Type, No. 24198, Mus. Comp. Zool.); JORDAN & EIGENMANN, *l. c.*, 372, 1890.
*Epinephelus xenarchus*, BOULENGER, Cat., I, 266.

## Subgenus PAREPINEPHELUS, Bleeker.

### 1570. MYCTEROPERCA RUBER (Bloch).

(SCIRENGA.)

Head $2\frac{1}{2}$ in length; depth $2\frac{4}{5}$. D. XI, 16; A. III, 11 or 12; scales 15–95 to 115–40 to 46, pores 75 to 85. Body rather deep, compressed, the snout sharp, the anterior profile straight; interorbital space flat or convex, 4 to $5\frac{1}{2}$ in head; mouth moderate, the maxillary extending just beyond eye, $2\frac{1}{3}$ in head; eye $4\frac{1}{2}$ to 7 in head; canine teeth small; preopercle with a salient angle; gill rakers very long and slender, x + 31 (22 to 35 according to Boulenger), the longest $\frac{4}{5}$ diameter of eye and $7\frac{1}{2}$ in head; dorsal spines small; soft dorsal slightly angulated, the longest ray $2\frac{4}{5}$ in head; anal fin (in most specimens, especially in adults) sharply angulated as in *M. falcata*, the longest ray $1\frac{7}{8}$ in head, in young specimens rounded; caudal lunate, the angles well produced in the adult, the fin subtruncate in young; pectoral $1\frac{5}{6}$ in head; ventrals short, not reaching vent, ($2\frac{3}{4}$ to $3\frac{1}{4}$, Boulenger). Coloration grayish olive, with reticulations of dark around irregular roundish pale spots; a black mustache along edge of maxillary; fins not much darker than body, usually dusky at tip; young with the markings more distinct than they are in the adults; young sometimes with a dark blotch on back of caudal peduncle, according to Boulenger. This description is chiefly from No. 4805, M. C. Z., from Rio de Janeiro, 13 inches long. This species is very well distinguished from all other groupers by the greatly increased number of gill rakers, a character first pointed out by Dr. Bean. Perhaps more than one species of this type exists, distinguished by the number of gill rakers. The type of *ruber* has but 24. Those examined by us from Brazil and from Athens have 30 or more. West Indies, Brazil, Mediterranean Sea, and islands of the eastern Atlantic; common in the Mediterranean and off the coast of Brazil. (*ruber*, red; from the supposed coloration of the original bleached specimen, which may possibly have been a deep-water form.)* (Eu.)

*Epinephelus ruber*, BLOCH, Ichthyologia, VII, 22, 1793, pl. 330, "Japan"; BOULENGER, Cat., I, 268.

*Mycteroperca scirenga*, JORDAN & SWAIN, *l. c.*, 369, 1884 (not *Sparus scirenga*, RAFINESQUE, which is an *Epinephelus*).

*Serranus acutirostris*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., II, 286, 1828, Brazil; GÜNTHER, Cat., I, 135, 1859.

*Serranus undulosus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., II, 295, 1828, Brazil; GÜNTHER, Cat., I, 143, 1859.

*Serranus tinca*, CANTRAINE, "Nouv. Mém. Ac. Brux., 1831, XI," Naples.

*Serranus fuscus*, LOWE, Trans. Cambr. Philos. Soc., VI, 196, 1836, Madeira; GÜNTHER, Cat., I, 134, 1859.

*Cerna nebulosa*, COCCO, "Indice Pesci Messina, Gen. 45, sp. 2," 1844, Messina.

*Cerna macrogenis*, SASSI, "Descr. Genova e il Genovasato, I, 139," 1846, Genoa.

*Serranus emarginatus*, VALENCIENNES, Ichth. Iles Canaries, 10, 1850, Canary Islands.

*Epinephelus chalinius*, COPE, Trans. Am. Philos. Soc., 1871, 465, St. Martins.

*Cerna acutirostris*, var. *lata*, DODERLEIN, *l. c.*, 74, Palermo; monstrous form.

*Serranus ruber*, PETERS, Berliner Monatsb., 107, 1865, (redescription of original type).

*Mycteroperca rubra*, JORDAN & EIGENMANN, *l. c.*, 372, 1890.

### Subgenus XYSTROPERCA, Jordan & Evermann.

### 1571. MYCTEROPERCA PARDALIS,† Gilbert.

(CABRILLA PIRITITA.)

Head $2\frac{4}{5}$ in length; depth 3; snout $3\frac{1}{2}$; eye 6. D. XI, 17; A. III, 11; scales 90. Lower jaw strongly projecting. Teeth small, the outer row in mandible

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*In case a red form of this species should be found, the ordinary brown form or variety may be called var. *acutirostris*. It is possible, also, as above indicated, that *Mycteroperca acutirostris*, to which form the above description belongs, is really a distinct species. The following comparison of Bloch's type of *Epinephelus ruber*, .165 meters in length, from "Japan," with *Mycteroperca acutirostris*, is made by Dr. Hilgendorf, who writes: "The gill rakers are indeed numerous. I count 24 on the ceratobranchial of the first arch. The longest of these measures $6\frac{1}{2}$ millimeters. The points in which *ruber* differs from *acutirostris* (compared with a larger example—12581, .283 millimeters long, from Athens) are the following: The pale coloration, which is hardly to be explained by bleaching, as the dark-brown pigment suffers little, nor is it to be accounted for by difference in age. The caudal is in *ruber* apparently strongly rounded, and the pectorals as well as ventrals are longer in *ruber*. The ventrals reach at least to the vent. The point of the pectoral is 78 millimeters from the snout, 86 millimeters from the end of the caudal (as 7 to 8). In *acutirostris* these numbers are respectively 123 and 160 millimeters (as 3 to 4). This difference may be expressed by saying that in *acutirostris* (or in old examples?) the hinder parts of the body are more stretched. The streaks on the sides shown in Bloch's figure are merely the boundaries of the groups of muscles." The difference in the form of the caudal above noticed may, we know, be due to age, as in specimens of 6 inches it is very rarely lunate. The difference in form is not unlikely also a matter of age. The pale color of the type of *Epinephelus ruber* may be due to exposure of the type to sunlight. A few weeks of such exposure will destroy all pigment cells. As the specimen has now been more than a century in alcohol, such an exposure may have some time taken place.

† The following description is taken from a specimen from the Venados Islands, near Mazatlan: *Mycteroperca pardalis*.—Head 3 in length; depth $3\frac{1}{10}$. D. XI, 16; A. III, 11; scales 90 to 100, small, smooth, embedded, difficult to count. Eye $6\frac{2}{3}$ in head; maxillary $2\frac{1}{2}$; pectoral $1\frac{2}{3}$;

rigid, smaller than those of the inner series, which are depressible. The inner series widens into a patch at symphysis, in front of which stands the pair of very small inconspicuous canines. Outer series of teeth in upper jaw enlarged, canine-like, growing larger toward median line, where they terminate in 2 strong canines on each side. A patch of depressible teeth behind these canines in front of jaw, rapidly diminishing in size and becoming finely villiform on middle of premaxillaries. A U-shaped patch of villiform teeth on vomer, those laterally the largest, and a very narrow band on palatines; tongue covered with minute teeth. Maxillary reaching vertical behind middle of eye, 2¼ in head. Interorbital space strongly convex transversely, 4½ in head. Fourth dorsal spine the longest, 3⅕ in head, the second ⅔ its height; longest ray of soft dorsal 2⅓ in head, the outline of fin everywhere convexly rounded; anal spines strong and low, the second half the height of the third, which equals length of eye and snout; soft rays high, the angle rounded, the posterior portion of fin straight, not concave; longest anal ray half head; caudal lunate, the longest ray 1⅗ in head. Scales small, not arranged in regular series, partially embedded, those on head and hinder part of body smooth; head wholly scaled, except premaxillaries and anterior part of maxillaries; fins naked, except basal half of caudal; sides covered with numerous very minute accessory scales; scales apparently in about 90 transverse series above the lateral line, but extremely difficult to determine; scales on cheeks, top of head, and above the lateral line anteriorly much reduced in size. Color in spirits: Sides of head and body everywhere profusely covered with round brown spots, those on caudal peduncle largest, half the diameter of the pupil, those anteriorly and above becoming much smaller, those on top of head about the size of a pin head; on sides these spots are surrounded with reticulations of grayish silvery, this ground color darker and brownish on upper parts; a dark brown streak behind the maxillary, and one on membrane of premaxillary; vertical fins light, soft dorsal and anal with brown streaks on membranes between the rays on basal half, and a few indistinct brown spots on middle of fin; caudal brown spotted, with a narrow white margin; pectorals light at base, the distal half blackish, with a wide pale border posteriorly; ventrals with brown streaks along membranes on inner face. (Gilbert.) Length 2 feet.

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longest anal ray 1¾; longest dorsal ray 2; longest dorsal spine 3½. Caudal, upper lobe 1⅓; ventrals 2. Body deep, robust; anterior profile rather steep and straight; lower jaw moderately projecting. Small canines in both jaws; preopercle with notch and a salient angle. Gill rakers about 15 + 25, rather stout, the longest about 7½ in head; snout 3½. Posterior nostril oblong, 4 times as long as anterior. Dorsal spines low, the third and fourth but little longer than the last. Dorsal fin pointed; anal very high, triangular in form, anterior margin convex, posterior concave. Sixth soft ray very high, reaching far beyond tip of last, which is short; spines graduated. Caudal fin broad, on a broad peduncle, unequally lunate. Upper lobe longer and broader than lower. Pectorals rounded. Color: Olive gray ground, paler below, clouded with dark above; everywhere covered with small, roundish, dark olive or bronzed spots, so thick as to obscure the ground color; very close-set on head and back, small and distinct, not larger than anterior nostril, growing larger and less thick, dense below; posteriorly still larger, often half diameter of pupil, and tending to run together, forming elongate blotches and vermiculations. Dorsal similarly spotted with spots which grow faint in soft rays; pectoral, anal, and caudal like soft dorsal. All soft fins growing dusky toward margin. Soft dorsal, anal, and caudal very narrowly edged with pale. Pectoral with broader pale margin; ventral like pectoral, pale edge narrower. When seen from back an appearance of about 10 very faint dusky cross shades, probably more conspicuous in young.

Gulf of California; rather common about the rocky islands about Mazatlan; a handsome species, valued as food. (*πάρδαλις*, leopard.)

*Mycteroperca pardalis*, GILBERT, Proc U. S. Nat. Mus., 1891, 551, La Paz Bay, Lower California. (Coll. Albatross.)

*Epinephelus pardalis*, BOULENGER, Cat., I, 268.

### Subgenus MYCTEROPERCA.

### 1572. MYCTEROPERCA OLFAX (Jenyns).

(YELLOW GROUPER.)

Head $2\frac{9}{10}$ to 3; depth $3\frac{1}{3}$; eye small, 7 in head. D. XI, 17; A. III, 11; scales 20–110 to 120–50, pores 75. Body robust, not strongly compressed; head deep, the snout rather sharp, the anterior profile steep; mouth large, the maxillary reaching somewhat beyond eye, $2\frac{1}{5}$ in head, its surface scaly; teeth moderate; lower jaw prominent; canines normal; nostrils large, very close together, separated by a narrow, vertical septum, the posterior about 3 times the diameter of the anterior, which is broader than the septum; preorbital as broad as eye; interorbital area flattish and broad, $4\frac{2}{3}$ in head; gill rakers coarse and long, x + 15; preopercle without salient angle, its notch moderate; scales small, chiefly cycloid. Dorsal spine strong, the second and third elevated so that the posterior outline of the fin is concave, first spine just half the second, second and third equal, $2\frac{2}{3}$ in head, fourth $1\frac{1}{2}$ in third; soft dorsal scarcely angular; pectorals $1\frac{2}{3}$ in head; ventrals short, scarcely reaching vent; caudal fin shallow-lunate; soft anal falcate, its posterior margin concave, the longest rays $2\frac{1}{3}$ in head. Color brown, with some traces of grayish vermiculations around small round brown spots; fins all dusky, especially distally; young covered all over with round brown spots, much smaller than the pupil; a black mustache; pectoral with a narrow pale edge. (Description from No. 24198, M. C. Z., 2 feet long, from James Island, Galapagos.) Galapagos Islands; Panama. Length 2 or 3 feet. (*olfacto*, to smell, from the large size of the nostrils.)

*Serranus olfax*, JENYNS, Zoöl. Beagle, Fishes, 9, pl. 4, 1840, Galapagos Islands (Coll. Darwin); GÜNTHER, Proc. Zoöl. Soc. London, 1877, 67.

*Mycteroperca olfax*, JORDAN & SWAIN, *l. c.*, 1884, 376; JORDAN & EIGENMANN, *l. c.*, 367, 1890.

*Epinephelus olfax*, BOULENGER, Cat., I, 263.

Represented in deep water about the Galapagos Islands by

### 1572a. MYCTEROPERCA OLFAX RUBERRIMA, Jordan & Bollman.

A large specimen taken by the *Albatross* at Abingdon Island, in the Galapagos, seems to have been bright red in life. It probably represents a deep-water variety analagous to the red varieties of West Indian species. The anal is a little lower than in an equally large specimen of the typical *olfax* taken in the same locality. No other difference is apparent. Abingdon Island, Galapagos Group. (*ruberrimus*, very red.)

*Mycteroperca olfax ruberrima*, JORDAN & BOLLMAN MS. in JORDAN & EIGENMANN, Review Serranidæ, 367, 1890, Abingdon Island.

*Mycteroperca olfax*, JORDAN & BOLLMAN, Proc. U. S. Nat. Mus., 1889, 181; in part.

### 1573. MYCTEROPERCA ROSACEA (Streets).

(CABRILLA CALAMARIA.)

Head $2\frac{4}{5}$; depth $2\frac{7}{8}$; eye 7 in head (adult). D. XI, 18; A. III, 11; scales 25–130–10. Body rather elongate, compressed; head large, compressed, pointed anteriorly, the anterior profile nearly straight or slightly convex; snout rather long and sharp, $3\frac{1}{3}$ in head. Mouth large, the maxillary reaching to opposite posterior margin of eye, its length 2 in head. Teeth in moderate bands; canines of moderate size, nearly vertical, the lower turned somewhat backward. Interorbital space strongly convex, its breadth about 4 in head. Preopercle with the angle a little salient, the emargination above it rather distinct, the teeth small, those near the angle being somewhat enlarged. Nostrils rounded, very close together, the posterior much the larger. Gill rakers rather few and long, about 17 on lower part of anterior arch. Scales small, chiefly cycloid. Dorsal spines rather slender and low, the third $3\frac{2}{5}$ in head; soft dorsal moderate; caudal fin distinctly lunate, the upper lobe the longer, $1\frac{3}{4}$ in head; anal very high and falcate, the middle rays produced in a point, their length $1\frac{9}{10}$ in head, the posterior rays rapidly shortened, so that the outline of the fin is much concave; anal spines small, graduated; pectorals reaching beyond tips of ventrals, 2 in head. Color in life: Body and fins nearly uniform brick red; tip of pectorals dusky; vertical fins without distinct dusky edgings. In spirits, fading first to lemon color, then to dull gray. Gulf of California. But three specimens, all adult, of this beautifully colored species are known. The first was secured by Dr. Streets at Angel Island; the second, described above (28131, U. S. N. M.), obtained at Mazatlan by Dr. Gilbert, where it is very rare; and the third obtained by Dr. Jordan in December, 1894, from Venados Islands, near Mazatlan. Length of specimen described, 38 inches. The brown form, if existing, is unknown. (*rosaceus*, rosy.)

*Epinephelus rosaceus*, STREETS, Bull. U. S. Nat. Mus., VII, 51, 1877, Angel Island, Gulf of California; BOULENGER, Cat., I, 262.

*Trisotropis rosaceus*, JORDAN & GILBERT, Bull. U. S. Fish Comm., II, 1882, 107.

*Mycteroperca rosacea*, JORDAN & SWAIN, *l. c.*, 362, 1884; JORDAN & EIGENMANN, *l. c.*, 368, 1890.

### 1574. MYCTEROPERCA FALCATA (Poey).

(SCAMP; BACALAO; ABADEJO.)

Head $2\frac{7}{8}$ to 3; depth $3\frac{1}{3}$ to $3\frac{1}{2}$; eye large, 5 in head (in adult). D. XI, 16 to 18; A. III, 11; scales 22–130 to 140–47 to 55, pores 72 to 85. Body moderately elongate, compressed, its greatest width $2\frac{2}{5}$ in its depth; head compressed, rather pointed anteriorly, the anterior profile nearly straight. Mouth rather large, the maxillary reaching posterior border of eye, $2\frac{1}{5}$ in head; teeth in rather narrow bands; each jaw with two strong canines, rather larger than in any related species, those of the upper jaw directed very strongly forward and slightly downward; those of the lower jaw a little smaller, and directed similarly upward and backward. Interorbital space slightly convex, 5 in head. Nostrils close together, the posterior the larger. Upper limb of preopercle slightly convex, very finely serrate; a rather sharp notch above the angle, which is salient, and bears a few coarse teeth. Gill rakers rather elongate, 15 or 16 besides rudiments, 19 or 20 in all, on lower part of anterior arch. Scales small, mostly cycloid. Dorsal spines rather slender and weak, the outline of the fin gently curved, the second spine about equal to the eighth and higher than the tenth; the third and fourth spines longest, $2\frac{4}{5}$ in head; caudal with falcate lobes; anal with its middle rays exserted; longest ray of anal $2\frac{1}{4}$ in head; upper lobe of caudal $1\frac{1}{3}$. Pectoral reaching tips of ventrals, $1\frac{4}{5}$ in head. Ventrals short, not reaching vent. Pyloric cœca 15. Color in life, brown above; sides grayish brown, faintly covered with darker spots which disappear in spirits; eyes and angle of mouth yellowish; vertical fins dusky, the outer portions bluish black; ventrals and pectorals bluish black, the pectorals with a whitish edge. Length 2 to 3 feet. West Indies, north to Bermuda; a common food-fish at Havana. (*falcatus*, scythe-shaped.)

*Serranus falcatus*, POEY, Memorias, II, 138, 1860, Havana.
*Trisotropis falcatus*, POEY, Synopsis, 285, 1868.
*Mycteroperca falcata*, JORDAN & SWAIN, *l. c.*, 1884, 362; JORDAN & EIGENMANN, *l. c.*, 368, 1890.
*Epinephelus falcatus*, BOULENGER, Cat., I, 261.

Represented on the Florida Coast by

### 1574a. MYCTEROPERCA FALCATA PHENAX, Jordan & Swain.

(SCAMP; BACALAO.)

Specimens from the Florida Coast differ somewhat from all those observed at Havana. The chief difference is in the direction of the canine teeth, which are rather weaker than in var. *falcata*, those of the upper jaw scarcely directed forward, those of the lower scarcely backward. The serræ on the preopercle are rather weaker than in var. *falcata*, and there is some difference in color, as is shown in the following notes on a specimen from Key West: Head 3; depth $3\frac{2}{5}$. D. XI, 18; A. III, 11; scales 24–135–10. Color in life: Pinkish gray above, paler purplish gray below; upper parts and opercle thickly covered with small, rounded, irregular spots of dark brown; sides with larger and fainter brown blotches, more or less horizontally oblong, and somewhat reticulate; spinous dorsal brownish; soft dorsal darker, faintly spotted, edged with dusky and with a narrow rim of whitish anteriorly; caudal brownish, spotted with darker, its outer rays blackish posteriorly; anal dusky, blackish anteriorly, and edged with whitish; pectorals plain, dusky toward the tips, edged with whitish; ventrals pale, tipped with dusky; mouth pale, scarcely greenish. Length about 2 feet. Coasts of southern Florida; abundant about the Keys. (φέναξ, deceptive, equivalent to "scamp.")

*Trisotropis falcatus*, GOODE & BEAN, Proc. U. S. Nat. Mus., 1879, 140; JORDAN & GILBERT, Synopsis, 538, 1883.
*Epinephelus falcatus*, JORDAN, Proc. U. S. Nat. Mus., 1884, 124.
*Mycteroperca falcata phenax*, JORDAN & SWAIN, Proc. U. S. Nat. Mus., 1884, 363, Key West; JORDAN & EIGENMANN, *l. c.*, 368, 1890.

### 1575. MYCTEROPERCA VENADORUM, Jordan & Starks.

(GARLOPA.)

Head $3\frac{1}{6}$ in length; depth $3\frac{1}{4}$. D. XI, 16; A. III, 11; scales small, smoothish, about 130. Snout 3 in head; maxillary 2; eye 8. Gill rakers 3 + 8; pectorals $1\frac{9}{10}$; fourth dorsal spine $3\frac{3}{5}$; longest dorsal rays 3; longest anal ray $2\frac{1}{5}$; caudal lobe $1\frac{3}{4}$. Ventrals $2\frac{1}{4}$, measured to bony opercle. Body robust, not strongly compressed, the head large. Lower jaw much projecting. Posterior nostril 3 times diameter of anterior. Preopercle scarcely notched, its angle scarcely salient, its teeth a little enlarged. Gill rakers short, thick, few in number. Dorsal deep-notched, second spine a little lower than the fourth; soft dorsal high, slightly angulated; anal very high, with exserted rays; caudal well forked, lobes unequal. Color: Olive brown, almost uniform, no spots or bands; dorsal, anal, and caudal with broad black margin narrowly edged with whitish; pectoral and ventral darker behind; pectoral with pale edge. Gulf of California; not rare about rocky islands. The type, a specimen from the Venados Islands, weighing in life 75 pounds, has been sent as a skin to the British Museum. Its length was 40 inches to base of caudal fin. The species reaches a weight of 150 pounds, and is a food-fish of importance. (Name from the Venados Islands near Mazatlan; *Venado*, hunted, the Spanish name of the deer, *Mazatlan* being the Indian equivalent of the same word.)

*Mycteroperca venadorum*, JORDAN & STARKS, Fishes of Sinaloa, in Proc. Cal. Ac. Sci., 1895, 446, Venados Islands. (Coll. Hopkins Exp. Type in British Museum.)

### 1576. MYCTEROPERCA CALLIURA, Poey.

Head 3; depth 3. D. XI, 16; A. III, 11; scales 90 to 100; eye 5 in head; snout $4\frac{2}{3}$. Body rather deep and compressed; preopercle with salient angle; gill rakers x + 12; nostrils as in *M. tigris*, the posterior considerably the larger, the two close together, the larger with an interior horizontal cross partition at base; anal scarcely angulate. Pyloric cœca 12, large and firm. Color in spirits, brownish everywhere, with grayish reticulations around small brown spots, these not larger than pupil and not evident on head; fins all edged with dusky. According to Poey the color is dark brownish olive, with rounded spots of yellowish, obscure in some specimens; lips yellowish; iris olive; fins dark brown, darker on the edges of the vertical fins, with a pale edge along the soft dorsal and anal; 8 narrow dusky cross bands, which disappear after death. Caudal with a beautiful green cross band, preceding the denticulations of its extremity. The pectoral toward the center is yellowish, followed by a dark color coming from the coloration of the rays; all the posterior margin is green. Length $1\frac{1}{2}$ feet. Coast of Cuba; very rare; here described from No. 10011, M. C. Z., 14 inches long, apparently one of Poey's types. (*κάλλος*, beauty; *οὐρά*, tail.)

*Mycteroperca calliura*, POEY, Repertorio, I, 181, 309, 1867, Cuba; JORDAN & EIGENMANN, *l. c.*, 368, 1890.

*Trisotropis calliurus*, POEY, Synopsis, 284, 1868; JORDAN & SWAIN, *l. c.*, 366, 1884.

*Epinephelus calliurus*, BOULENGER, Cat., I, 264.

### 1577. MYCTEROPERCA TIGRIS (Cuvier & Valenciennes).

(Bonací Gato.)

Head 2$\frac{4}{5}$; depth 3$\frac{2}{3}$. D. XI, 16 or 17; A. III, 10 or 11; scales 18–125 to 135–50 to 55, pores 80 to 85. Body moderately elongate, rather strongly compressed. Head large, the anterior profile rather more strongly curved than in most species, somewhat gibbous above the eyes; snout not very acute, 3$\frac{4}{5}$ in head. Mouth very large, oblique, the maxillary extending to beyond the eyes, its length 2$\frac{1}{8}$ in head. Canines moderate, nearly vertical. Lower jaw strongly projecting; eye 6$\frac{2}{3}$ in head. Posterior nostril much larger than anterior, the two close together and close to eye. Interorbital space strongly convex, its breadth 5$\frac{2}{3}$ in head. Preopercle forming a regular curve, without salient angle or conspicuous emargination. Gill rakers very short and broad; about 6 developed on lower half of arch, besides about 3 rudiments. Scales rather small, chiefly cycloid. Dorsal spines rather slender, the second, third, and fourth subequal, 3$\frac{1}{2}$ in head; soft dorsal slightly angulated, the tenth ray slightly longer than the others, 3 in head; caudal truncate or somewhat lunate, the outer rays 1$\frac{9}{10}$ in head; anal high, slightly angulated, the largest rays 2$\frac{2}{3}$ in head; anal spines short, graduated; pectorals reaching somewhat beyond tips of ventrals, 2 in head; ventrals short, not reaching vent. Color in spirits, olivaceous; the head covered with very distinct honeycomb-like reticulations of darker olive, surrounding pale spots, from the size of the nostril to that of the pupil; body showing traces of such spots; fins plain, the soft dorsal and anal edged with blackish. Color in life, olive brown, with about 5 pale, grayish cross bands, narrower than the interspaces; these bands about obsolete in spirits; all the fins bluish black, the vertical fins edged with whitish, the pectorals tipped with orange; top of head reddish, becoming dusky in spirits. Length of specimen described (6708, U. S. N. M.) from Barbadoes, 19 inches. West Indies; not very common; north to Bermuda. (*tigris*, tiger.)

*Serranus tigris*, Cuvier & Valenciennes, Hist. Nat. Poiss., ix, 440, 1833, San Domingo; Günther, Cat., i, 112.
*Serranus felinus*, Poey, Memorias, ii, 134, 1860, Havana.
*Serranus repandus*, Poey, Memorias, ii, 135, 1860, Havana.
*Trisotropis reticulatus*, Gill, Proc. Ac. Nat. Sci., 1865, 105, Barbadoes; coloration faded.
*Trisotropis tigris*, Poey, Ann. Lyc. Nat. Hist. N. Y., 1869, 307.
*Mycteroperca reticulata*, Jordan & Swain, *l.c.*, 373, 1884.
*Serranus rivulatus*, Poey, Memorias, ii, 135, 1860.
*Mycteroperca tigris*, Jordan & Swain, *l. c.*, 364, 1884; Jordan & Eigenmann, *l. c.*, 369, 1890.
*Epinephelus tigris*, Boulenger, Cat., i, 259.

Represented in deep waters by a red form or subspecies,

### 1577a. MYCTEROPERCA TIGRIS CAMELOPARDALIS (Poey).

Ground color bright red, otherwise as in *Mycteroperca tigris*. West Indies. (*camelopardalis*, like a giraffe or camelopard in color.)

*Serranus camelopardalis*, Poey, Memorias, ii, 132, 1860, Havana.
*Trisotropis camelopardalis*, Poey, Synopsis, 283, 1868; Enumeratio, 14, 1875.

## 506. CRATINUS, Steindachner.

*Cratinus*, STEINDACHNER, Ichthyol. Beiträge, VII, 19, 1878, (*agassizii*).

Body subfusiform, moderately compressed; the head long and low; cranium essentially as in *Serranus*, the smooth area above very large, longer than the low and short supraoccipital crest. Lower jaw much projecting. Canines small. Scales small and rough. Gill rakers moderate. Dorsal spines very unequal, most of them attenuated into long filaments without dermal appendage. Caudal slightly lunate. East Pacific. This genus is related to *Paralabrax*,* differing in the form of the head and in the prolongation of most of its dorsal spines, which are attenuated into filaments without dermal appendage. One species known, a fish with a very peculiar physiognomy. (Name unexplained; perhaps from *crates*, a bundle of rods.)

### 1578. CRATINUS AGASSIZII, Steindachner.

Head to end of the opercular flap $2\frac{5}{6}$ in length; depth 4. D. X, 12; A. III, 7; eye 9 in head; snout $2\frac{3}{4}$; maxillary $2\frac{1}{2}$; pectoral 2; ventrals slightly shorter; longest ray of soft dorsal 3; second anal spine $5\frac{1}{3}$; scales 9–68–22. Body elongate, not much compressed; profile gently curved from tip of snout to dorsal; snout long and pointed; mouth large, not very oblique; maxillary extending to posterior margin of eye; lower jaw strongly projecting; teeth moderate, in several irregular series; nostrils equal, nearly round, the space between them as great as their diameter, the anterior one with a flap on its posterior margin; eye small, set high in the head; interorbital shallowly and evenly concave; supraoccipital ridge extending nearly to upper angle of opercle; rounded posterior limb of preopercle finely serrate, lower limb entire; opercle with a broad, flat spine, behind which is a large flap. Gill rakers moderate, rather slender, 3 + 9, with 3 or 4 rudimentary ones. Snout, preorbital, interorbital, and upper edge of maxillary with a few scattered, partially embedded scales, with much naked skin between; lower part of maxillary and lower jaw naked; cheeks closely set with small scales, opercles with much larger ones; many accessory scales on head. Scales on body large, without accessory scales; a few small scales running up on base of soft dorsal; all scales on body and head ctenoid. First dorsal spine short, not much longer than eye, the second slightly longer; third, fourth, fifth, and sixth extremely long, longer than head, and reaching to the middle of soft dorsal, the rest not elongate; soft dorsal moderately high, the first rays the longest; second anal spine about twice as long and much stouter than first, third slender, a little longer than second, and closely united to first anal ray, the middle rays the longest, twice as long as second spine, fin rounded behind; pectorals broad, the middle rays longest, the fin bluntly rounded behind, reaching a little past ventrals; caudal fin shallow-lunate. Color in spirits: Snout and upper parts dark brown, light below; dorsal, anal, and ventrals dark. Galapagos Archipelago; scarce; the specimens here described from Charles Island, one of the Galapagos, the largest about 18 inches long. The posterior half of the body resembles that of the species of *Paralabrax*; the long, low head suggests *Philypnus*. (Named for Professor Louis Agassiz.)

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* Dr. Boulenger is certainly in error in referring this species to his subgenus *Serranus*.

*Cratinus agassizii*, STEINDACHNER, Ichth. Beitr., VII, 19, 1878, Galapagos Islands (Coll. Agassiz & Steindachner); JORDAN & EIGENMANN, *l. c.*, 394, 1890.
*Serranus agassizii*, BOULENGER, Cat., I, 282.

## 507. HYPOPLECTRUS, Gill.

### (VACAS.)

*Hypoplectrus*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 236, (*puella*).

Body more deep and compressed than in the other groups allied to *Serranus*. The skull differs from that of *Serranus* chiefly in the development of the supraoccipital crest, which, in accordance with the form of the body, is much elevated. The smooth area on top of cranium is large, extending backward to border of preopercle, the supraoccipital and parietal crests being short; the ventrals, as in *Serranus*, are behind the axil of the pectoral. All the species have several antrorse serræ on the lower limb of the preopercle, but smaller than in *Gonioplectrus*. The species of *Hypoplectrus* are all American, and a study of their relations offers many difficulties. We have examined typical examples of a large number of the nominal species. While each of these shows certain striking peculiarities in color, most of them are absolutely identical, one with another, in all other respects. Moreover, even among those in which the coloration seems most sharply defined, there are many variations. After an examination of the large series of typical forms sent by Professor Poey to the Museum at Cambridge, we find ourselves driven to the conclusion that all the common forms of *Hypoplectrus* probably constitute but a single species, subject to almost endless variations in color. This view we here adopt, leaving for convenience sake the various nominal species to stand as color varieties or subspecies, produced by the action of some agencies as yet unknown. (*ὑπό*, below; *πλῆκτρον*, spur.)

*a.* Scales large, about 46 pores in lateral line; body short and deep, the depth $2\frac{1}{4}$ in length; head $2\frac{3}{5}$; profile from dorsal to occiput convex, concave above eye; preorbital narrow; maxillary reaching to below middle of eye; lower jaw slightly included; teeth strong, large teeth in front $\frac{4}{6}$; fourth dorsal spine highest, $2\frac{1}{5}$ in head; middle caudal rays little shorter than the outer ones; pectoral reaching anal; teeth of preopercle growing larger downward; angle and lower limb with about 9 strong radiating serræ, those nearest the angle largest, the others directed more and more forward. Color (of the single specimen known) black with violet luster; faint, pale streaks along the rows of scales on lower parts of body; caudal fin abruptly translucent yellowish; pectorals colorless; tips of dorsal and anal spines and edge of soft rays abruptly whitish. LAMPRURUS, 1579.

*aa.* Scales moderate, 60 to 65 pores in the lateral line; dorsal rays X, 15; depth 2 to $2\frac{1}{4}$ in length, the head about 3; maxillary 2 in head; caudal fin slightly lunate; fourth dorsal spine highest, $2\frac{3}{8}$ in head; pectorals narrow, about reaching second anal spine; gill rakers short and slender, x + 12. Coloration extremely various, characterizing many nominal species or varieties described below. UNICOLOR, 1580.

*aaa.* Scales small, 70 to 80 in the lateral line.

*b.* Caudal forked. Color purple with lighter cloudings; fins colorless, the external caudal ray darker; caudal deeply lunate, the external rays much prolonged, especially those of the upper lobe, which are twice as long as the middle rays. Depth $2\frac{1}{3}$ in length. Scales 9–70–32. GEMMA, 1581.

### 1579. HYPOPLECTRUS LAMPRURUS (Jordan and Gilbert).

Head $2\frac{3}{5}$; depth $2\frac{1}{4}$. D. X, 15; A. III, 8; scales 6–60–x, pores 46; snout about as long as eye, which is $3\frac{1}{2}$ in head, greater than interorbital width; Body short and deep; profile from dorsal to occiput convex, concave above eye; preorbital narrow; maxillary reaching to below middle of eye; lower jaw slightly included; teeth strong; large teeth in front $\frac{4}{6}$; snout and top of head naked; cheeks and opercles scaly; fourth dorsal spine highest, $2\frac{1}{5}$ in head; middle caudal rays little shorter than the outer ones; pectoral reaching anal, a little shorter than head or than ventral; anal spines strong, the second longer and stronger than third; teeth of preopercle growing larger downward; angle and lower limb with about 9 strong radiating serræ, those nearest the angle largest, the others directed more and more forward; opercle with 2 flat spines. Color (of the single specimen known) black with violet luster; faint, pale streaks along the rows of scales on lower parts of body; caudal fin abruptly translucent yellowish; pectorals colorless; ventrals black; tips of dorsal and anal spines and edge of soft rays abruptly whitish. Panama; known from a single specimen; well distinguished from the Atlantic species by the much larger scales; the single type has almost exactly the coloration of the form called *Hypoplectrus chlorurus.* We can only guess as to the color variations which it may undergo. (*λαμπρός*, bright; *οὐρά*, tail.)

*Serranus lamprurus*, JORDAN & GILBERT, Bull. U. S. Fish Comm., I, 1881, 322, Panama. (Type, No. 29651. Coll. Gilbert.)

*Hypoplectrus lamprurus*, JORDAN, Proc. U. S. Nat. Mus., 1885, 376; JORDAN & EIGENMANN, *l. c.*, 384, 1890.

### 1580. HYPOPLECTRUS UNICOLOR* (Walbaum).

(VACA; PETIT-NÈGRE.)

Head $2\frac{2}{3}$ to 3; depth 2 to $2\frac{1}{3}$. D. X, 14 or 15; A. III, 8; scales 8 to 10–80 to 92–30 to 35, pores 52 to 60. Snout longer than eye, which is $3\frac{1}{2}$ to 4 in head; lower jaw slightly projecting, with small canines; maxillary 2 in head, reaching nearly to middle of eye; snout and top of head smooth; cheeks and opercles scaly; caudal fin slightly lunate; fourth dorsal spine highest, $2\frac{3}{5}$ in head; pectorals narrow, about reaching second anal

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*We have examined large numbers of specimens of this type in the Museum at Cambridge and elsewhere. The best series seen is that sent from Havana by Poey to the Museum at Cambridge. So far as we can discover, the various nominal species of this type are absolutely identical in all respects except in color. Many of them—*e. g.*, *puella*, *indigo*, *chlorurus*—seem at first sight to be certainly different. Nevertheless, each of these forms is subject to wide variations, and from the material which we have seen, we can draw no other conclusion than this: All belong to a single species, which varies excessively in its coloration. Blue, yellow, and black are arranged in great variety of patterns, in different specimens, and the cause of such variation is still unknown. The following localities are represented in the specimens examined by us: *puella*, Havana, St. Thomas, St. Croix; *vitulinus*, Havana; *pinnivarius*, Havana; *maculiferus*, Havana; *guttavarius*, Havana; *chlorurus*, Havana; *nigricans*, Florida Keys, Havana, St. Thomas; *indigo*, Havana. The other nominal species we have not seen.

spine, nearly as long as head, about equal to ventrals; third anal spine longest, as long as longest of dorsal; gill rakers short and slender, x + 12. Length 6 to 12 inches. West Indies, north to the Florida Keys on rocky shores; not recorded from Brazil; locally common and excessively variable as indicated above. Only the form called *nigricans* thus far recorded from the United States. Length about a foot. (*unicolor*, uniformly colored; a most inappropriate name even for the typical form.) Coloration extremely various, the following being the nominal species or varieties thus far described:

*a.* Soft dorsal checkered or spotted with pale blue or crossed by blue lines (these occasionally obsolete).

*b.* Body dusky, the head and belly orange, the top of the head olivaceous; a black spot on each side of caudal peduncle close behind dorsal; black band or spot in front of eye not bordered by blue; cheeks, opercle and breast with vertical lines of metallic blue; dorsal yellowish; pectoral and caudal orange; a black spot in the axil; upper margin of pectoral blue; anal orange with blue border; ventral greenish, its base orange. UNICOLOR (= MACULIFERUS), 1580.

*bb.* Body all violet with 5 or 6 more or less distinct black cross bands, the middle one broadest, covering the space from the fourth to the tenth dorsal spine and meeting its fellow under the belly; the band at the nape broad and saddle-like, bounded by 2 pale cross streaks on nape, opercle, and cheeks; snout pale, a pale shade across it; ventrals pale or dark; other fins, except spinous dorsal, mostly pale. Pores 60; 8 series above lateral line.

*c.* Cheek with a blue band before eye and some blue spots before it. PUELLA, 1580*a*.

*cc.* Cheek without blue band; no blue spots on snout; colors duller. VITULINUS, 1580*b*.

*bbb.* Body and head yellow anteriorly; body abruptly black posteriorly, the back extending forward to a wavy line reaching from first dorsal spine to vent; a broad dark-blue band in front of eye, bordered by sky blue; fins chiefly orange; ventral and anal bordered by sky blue. PINNAVARIUS, 1580*c*.

*aa.* Soft dorsal plain, without distinct blue lines or spots.

*d.* Preorbital region with 1 or more dark-blue stripes, bordered by bright sky blue (not fading in spirits).

*e.* Body yellow anteriorly, black posteriorly, the black extending forward to a line joining the nape and last anal ray; fins orange; a single blue-black stripe or spot in front of eye, ocellated with sky blue; caudal peduncle very dark above. GUTTAVARIUS, 1580*d*.

*ee.* Body all orange yellow, fins orange; snout and lower jaw blue; 2 blue stripes, each bordered with sky blue, before the eye. GUMMIGUTTA, 1580*e*.

*eee.* Body saffron yellow, orange posteriorly; snout with blue streaks and some blue dots. CROCOTUS, 1580*f*.

*dd.* Preorbital region without blue stripes; scales usually (?) smaller; pores 65, 11 series above lateral line.

*f.* Preorbital region with violet spots; a round black spot on side of caudal peduncle; dorsal light greenish; body light olive green above, reddish below; pectorals pale yellow, the first ray blue; ventrals, anal, and caudal light orange. ABERRANS, 1580*g*.

*ff.* Preorbital region without distinct violet spots.

*g.* General color blackish, brown, or yellowish—not indigo blue.

*h.* Color brownish, the middle of the front of body yellowish; fins all yellow except the ventrals, which are black. ACCENSUS, 1580*h*.

*hh.* Color yellowish pink; caudal and pectorals pale; ventrals and anal bright light blue. AFFINIS, 1580*i*.

*gg.* Color of body black with violet shades.

*i.* Pectoral and caudal fins abruptly bright yellow. CHLORURUS, 1580*j*.

*ii.* Pectoral and caudal fins violet black like the rest of the body. NIGRICANS, 1580*k*.

*j.* General color deep indigo blue everywhere on body and fins; body with 4 to 6 broad cross bars of darker blue.

*k.* Cheeks plain, without distinct stripes. INDIGO, 1580*l*.

*kk.* Cheeks with a dark-blue suborbital band between 2 bands of clear blue. BOVINUS, 1580*m*.

### 1580. HYPOPLECTRUS UNICOLOR (typical).

*Perca unicolor*, Walbaum, Artedi Piscium, III, 352, 1792, locality unknown; after *Percau unicolor*, Seba, Thesaurus, III, 76, tab. 27, fig. 10.
*Holocentrus unicolor*, Bloch & Schneider, Syst. Ichth., 322, 1801.
*Plectropoma ephippium*, Cuvier & Valenciennes, Hist. Nat. Poiss., II, 408, 1828, locality unknown; found among fishes from Java bought in Amsterdam.
*Hypoplectrus maculiferus*, Poey, Ann. Lyc. Nat. Hist. N. Y., x, 78, pl. 1, x, 2, 1871, Havana.
*Serranus unicolor*, Boulenger, Cat., I, 299.

### 1580a. HYPOPLECTRUS UNICOLOR PUELLA (Cuvier & Valenciennes).

*Plectropoma puella*, Cuvier & Valenciennes, Hist. Nat. Poiss., II, 405, pl. 37, 1828, Martinique; Günther, Cat., I, 165, 1859.
*Hypoplectrus puella*, Poey, Synopsis, 290, 1868; Jordan & Eigenmann, *l. c.*, 383.

### 1580b. HYPOPLECTRUS UNICOLOR VITULINUS (Poey).

*Plectropoma vitulinum*, Poey, Memorias, I, 68, 1851, Havana.
*Hypoplectrus vitulinus*, Poey, Enumeratio, 23, 1875.

### 1580c. HYPOPLECTRUS UNICOLOR PINNIVARIUS (Poey).

*Hypoplectrus pinnivarius*, Poey, Synopsis, 291, 1868, Havana.

### 1580d. HYPOPLECTRUS UNICOLOR GUTTAVARIUS (Poey).

*Plectropoma guttavarium*, Poey, Memorias, I, 70, 1851, Havana; Günther, Cat., I, 166, 1859.
*Plectropoma melanorhina*, Guichenot, Poissons, in Ramon de la Sagra, Hist. Cuba, 18, pl. 1, fig. 1, 1855, Havana.
*Hypoplectrus guttavarius*, Poey, Synopsis, 291, 1868.

### 1580e. HYPOPLECTRUS UNICOLOR GUMMIGUTTA (Poey).

*Plectropoma gummigutta*, Poey, Memorias, I, 70, 1851, Havana; Günther, Cat., I, 166, 1859.
*Hypoplectrus gummigutta*, Poey, Synopsis, 290, 1868.

### 1580f. HYPOPLECTRUS UNICOLOR CROCOTUS (Cope).

*Plectropoma crocota*,* Cope, Trans. Am. Phil. Soc. Phila., XIV, 1871, 466, St. Martins, West Indies. (Coll. Dr. R. E. Van Rijgersma.)
*Hypoplectrus crocotus*, Jordan & Eigenmann, *l. c.*, 386, 1890.

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*The following is the description of *Hypoplectrus crocotus* (Cope): "Form gibbous; depth 2.2 in length without caudal; length of head 3 times in same. Eye 3½ in head (including spine). Anterior rays of soft dorsal little more elevated than last ray of spinous fin. Radii D. X, 15; A. III, 7. Ventrals to anal; pectoral to first soft ray of anal; caudal moderately emarginate. Front concave in profile; muzzle a little longer than an orbit's diameter. Eight equal teeth on the lower limb of the preoperculum; end of maxillary to line of posterior margin of pupil. Scales 12–81–32. Length 4 5 inches. Color saffron yellow, becoming orange on the caudal, anal, and vertical fins; dorsal region becoming brownish anteriorly; a narrow band from front of orbit posteriorly on cheek, and some small blue spots on side of muzzle; a narrow blue line along upper edge of preoperculum; two faint vertical lines on operculum; dorsal and pectoral fins and jaws saffron yellow. This brilliant species was found at St. Martins, W. I., by Dr. R. E. van Rijgersma." (Cope.) The type specimen is no longer to be found in the collection of the Academy at Philadelphia.

### 1580g. HYPOPLECTRUS UNICOLOR ABERRANS (Poey).

*Hypoplectrus aberrans*, POEY, Synopsis, 291, 1868, Havana.

### 1580h. HYPOPLECTRUS UNICOLOR ACCENSUS (Poey).

*Plectropoma accensum*, POEY, Memorias, I, 72, 1851, Havana.
*Hypoplectrus accensus*, POEY, Synopsis, 290, 1868.

### 1580i. HYPOPLECTRUS UNICOLOR AFFINIS (Poey).

*Plectropoma affine.* POEY, Memorias, II, 427, 1861, Havana.
*Hypoplectrus affinis*, POEY, Enumeratio, 24, 1875.

### 1580j. HYPOPLECTRUS UNICOLOR CHLORURUS (Cuvier & Valenciennes).

*Plectropoma chlorurum*, CUVIER & VALENCIENNES, Hist Nat. Poiss., II, 406, 1828, Martinique; GÜNTHER. Cat., I, 167.
*Hypoplectrus chlorurus*, POEY, Synopsis, 290, 1868.
*Serranus chlorurus*, JORDAN & GILBERT, Synopsis, 537, 1883.

### 1580k. HYPOPLECTRUS UNICOLOR NIGRICANS (Poey).

*Plectropoma nigricans*, POEY, Memorias, I, 71, 1851, Havana.
*Hypoplectrus nigricans*, POEY, Synopsis, 290, 1868; JORDAN & GILBERT, Synopsis, 918, 1883.

### 1580l. HYPOPLECTRUS UNICOLOR INDIGO (Poey).

(AÑIL.)

*Plectropoma indigo*, POEY, Memorias, I, 69, 1851, tab. 3, fig. 1, Havana, GÜNTHER, Cat., I, 166.
*Hypoplectrus indigo* POEY Synopsis, 290, 1868.

### 1580m. HYPOPLECTRUS UNICOLOR BOVINUS (Poey).

*Plectropoma bovinum*, POEY, Memorias, I, 69, 1851, Havana; GÜNTHER, Cat., I, 166.
*Hypoplectrus bovinus*, POEY, Synopsis, 290, 1868.

### 1581. HYPOPLECTRUS GEMMA, Goode & Bean.

Head 2½; depth 2½; eye 4 in head. B. VII; D. X, 15; A. III, 7; C. 9 + 8; P. 14; V. I, 5; scales 9–70–32. Least height of the tail contained 3 times in the length of the head. The scales small, weakly ctenoid, about 76 in the lateral line, 9 above it, and 29 below (elsewhere stated as 9–70–32); lateral line following very closely the contour of the dorsal profile throughout its entire extent. Greatest length of head 3 in distance from the tip of snout to end of middle caudal rays. Snout 3 in head; operculum to end of flap equal to snout; upper jaw extending to vertical from anterior margin of orbit, its length equal to half that of head; lower jaw about the same length; armature and squamation of the opercular bones and dentition normal. Distance of dorsal fin from snout very slightly less than greatest height of body; length of dorsal base equal to distance between its origin and base of the posterior ray of anal fin, the fourth spine longest, its length equaling that of base of anal; anal fin inserted below origin of second dorsal ray, the base of its last ray being beneath that of ninth dorsal ray, its third spine very slightly longer than the second, their diameters equal; anal higher than dorsal, its greatest height equal to distance between base of the ventrals and origin of anal; caudal crescent-shaped, the external rays much prolonged, especially those of the upper lobe, which are twice as long as the middle caudal rays; distance of pectorals from snout equal to height of body at ventrals, their length equal to that of the superior caudal lobe; when extended horizontally these fins reach to vertical from insertion of first anal ray; distance of ventrals from snout equal to half standard body length; ventrals extending to insertion of anal, and equal in length to the rays of the lower caudal lobe. Color in alcohol, dull purple; in life, probably deep purple, with cloudings of lighter color; fins in alcohol colorless, in life probably pearly; external rays of the caudal corresponding in hue with the deeper portions of the body color. Florida Keys; known from one specimen from Garden Key; whether variable in color is of course, not known. (*gemma*, a jewel.)

*Hypoplectrus gemma*, Goode & Bean, Proc. U. S. Nat. Mus., 1882, 428, Garden Key, Florida, (Type, No. 3422); Jordan & Eigenmann, *l. c.*, 386, 1890.

## 508. PARALABRAX, Girard.

### (Cabrillas Verdes.)

*Paralabrax*, Girard, Proc. Ac. Nat. Sci. Phila., 1856, 131, (*nebulifer*).
*Atractoperca*, Gill, Proc. Ac. Nat. Sci. Phila., 1861, 165, (*clathratus*).
*Gonioperca*, Gill, Proc. Ac. Nat. Sci. Phila., 1863, 80, (*albomaculatus*).

Body robust, covered with small ctenoid scales. Mouth large, with small lateral canines and no depressible teeth. The smooth area on the top of the cranium is very short and small, not extending much behind the orbits. The long and low supraoccipital crest extending well forward to a line connecting the postfrontal processes. Ventral fins, as in *Serranus* and *Epinephelus*, inserted behind the axil of the pectoral. Caudal fin always lunate; some of the anterior dorsal spines considerably elevated. Dorsal rays usually X, 14; anal III, 7. The known species of *Paralabrax* are confined to the coasts of tropical America, where they are important food-fishes. (*παρά*, near; *Labrax*, *λάβραξ*, the sea bass or *Robalo* of Europe, *Dicentrarchus labrax*.)

*a.* Interorbital area more or less scaly, the scales extending forward at least to the middle of pupil; third dorsal spine longer than fourth; gill rakers x + 14 to 17; preorbital broad, as broad as eye in adult; some of the serræ on lower limb of preorbital hooked forward.

  *b.* Scales on top of head extending forward as far as front of eyes; no round dark spots anywhere except on cheeks and preorbital region; lower jaw projecting; eye moderate, shorter than snout, about 5½ in head; mouth large, the maxillary 2⅜ in head, rather narrower than the preorbital; first two dorsal spines short, the third very long, three times second and nearly 2 in head; caudal slightly lunate; second anal spine as long as third and much stouter; color greenish, with irregular pale and dark mottling and traces of dark oblique cross bars; preorbital, suborbital, and cheeks profusely marked with round orange spots; a dark streak downward and backward from eye. NEBULIFER 1582.

*bb.* Scales on top of head extending forward only to middle of eyes ; head and sides of body everywhere covered with dark orange spots ; gill rakers short and thick, x + 12, the longest $2\frac{1}{2}$ in eye ; body moderately elongate ; lower jaw projecting, but less so than in *P. nebulifer;* maxillary reaching middle of eye, $2\frac{2}{5}$ in head, scales quite rough. Second dorsal spine short, not half the third, which is $1\frac{4}{5}$ in head, the fourth scarcely shorter ; second anal spine shorter than third ; caudal slightly concave ; color olive brown, thickly covered everywhere above with dark hexagonal or roundish spots, so close together as to leave the ground color appearing as reticulations around them ; these spots are more or less confluent on the back, and are most distinct, and tinged with orange on sides of head, on branchiostegals, and on base of pectorals ; about seven dusky cross bars along the sides, in which the spots are deeper in color and more confluent ; a bluish stripe from eye across cheeks ; soft dorsal and caudal with bronze spots. MACULATOFASCIATUS, 1583.

*aa.* Interorbital area chiefly naked, the scales on top of head beginning more or less behind the pupil ; gill rakers x + 17 to 22 ; third dorsal spine scarcely longer than fourth.

*c.* Preorbital rather broad, more than three-fourths width of eye ; sides of back with large white spots ; fourth dorsal spine usually higher than third, so that the posterior margin of the dorsal fin is deeply concave ; snout $3\frac{1}{6}$ in head ; the scales beginning opposite last part of pupil ; gill rakers shortish, 9 + 19 ; first dorsal spine short ; second one-third longer ; third more than three times second ; fourth about the same ; anal spines short ; caudal lunate ; color dark above, abruptly pale below ; a large, dark, oblique dash below eye, covering most of cheek ; a row of five oblong, horizontal white blotches just below lateral line ; caudal dusky, its central and posterior part pale ; anal and ventral black ; pectoral pale ; spinous dorsal dusky at base ; soft dorsal mottled. HUMERALIS, 1584.

*cc.* Preorbital narrow, not two-thirds width of eye ; body well compressed ; snout pointed; preorbital narrow, not so broad as maxillary, less than half width of eye ; gill rakers rather long, x + 20 ; third, fourth, and fifth dorsal spines about equal, the third twice the second, 2 in head; second anal spine longer than third ; caudal fin slightly lunate ; color grayish green, with obscure broad dusky streaks and bars ; sides often shaded and mottled with bluish and greenish, but usually without distinct spots ; a broad, dark, longitudinal shade along axis of body ; belly plain silvery gray. CLATHRATUS, 1585.

### 1582. PARALABRAX NEBULIFER (Girard).

(JOHNNY VERDE.)

Head $2\frac{4}{5}$ in length; depth $3\frac{1}{3}$ to $3\frac{3}{4}$. D. X, 14 ; A. III, 7; scales 16–110 to 120–33, pores 72 to 86; about 32 scales from dorsal to occiput. Body rather elongate ; lower jaw projecting; eye moderate, shorter than snout, about $5\frac{1}{2}$ in head ; gill rakers half orbit, 8 + 14 to 17; preorbital broad, as broad as eye in adult; some of the serræ on lower limb of preorbital hooked forward ; scales on top of head extending forward as far as front of eyes ; no round dark spots anywhere except on cheeks and preorbital region ; interorbital nearly flat ; mouth large, the maxillary extending to below pupil, $2\frac{2}{5}$ in head, rather narrower than the preorbital ; first two dorsal spines short, the third very long, three times second and nearly 2 in head; soft dorsal rather low ; caudal slightly lunate; second anal spine as long as third and much stouter; pectorals moderate, $1\frac{1}{2}$ to $1\frac{3}{4}$ in head ; ventrals 2 to $2\frac{1}{2}$. Color greenish, with irregular pale and dark mottling and traces of dark oblique cross bars ; the colors faint as if faded; fins dusky, mottled ; preorbital, suborbital, and cheeks profusely marked with round orange spots ; a dark streak downward and backward from eye; lower side of head salmon color ; lower side of tail with wavy whitish streaks.

Southern California from Monterey to Magdalena Bay; generally common in shallow water; a food-fish of excellent quality. Length about 18 inches. Here described from San Diego specimens. (*nebula*, cloud; *fero*, I bear.)

*Labrax nebulifer*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, 142, Monterey.

*Paralabrax nebulifer*, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 132; GIRARD, U. S. Pac. R. R. Surv., 33, pl. XII, fig. 1, 1858; GÜNTHER, Cat., I, 62, 1859; JORDAN & EIGENMANN, *l. c.*, 388, 1890.

*Serranus nebulifer*, STEINDACHNER, Ichth. Beiträge, III, 1, 1875; JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1880, 456; BOULENGER, Cat., I, 280.

### 1583. PARALABRAX MACULATOFASCIATUS (Steindachner).

### (SPOTTED CABRILLA.)

Head 2½ to 3; depth 3. D. X, 13 or 14; A. III, 7; scales 17–92 to 120–35, pores 66 to 80; about 35 small scales from dorsal to occiput. Body moderately elongate; lower jaw projecting, but less so than in *P. nebulifer*; eye small, 5 to 6 in head, shorter than snout; interorbital gently convex; maxillary narrow, its width about half eye; preorbital wide, wider than eye. Top of head scaled on median line to front of pupil, naked on sides. Scales quite rough; scales on top of head extending forward only to middle of eyes. Gill rakers ⅗ in orbit, 6 + 13, the longest 2½ in eye. Second dorsal spine short, not half the third, which is 1⅘ in head, the fourth scarcely shorter; second anal spine shorter than third; pectoral moderate, 1½ in head; ventrals 1¾; caudal slightly concave. Color olive brown, thickly covered everywhere above with dark hexagonal or roundish spots, so close together as to leave the ground color appearing as reticulations around them; these spots are more or less confluent on the back, and are most distinct, and tinged with orange on sides of head, on branchiostegals, and on base of pectorals; about 7 dusky cross bars along the sides, in which the spots are deeper in color and more confluent; a bluish stripe from eye across cheeks; lower parts yellow; soft dorsal and caudal with bronze spots. Length about 18 inches. Lower Californian fauna, San Pedro to Mazatlan; everywhere common in sandy bays; a good food-fish. Here described from specimens from San Diego. (*maculatus*, spotted; *fasciatus*, banded.)

*Serranus maculatofasciatus*, STEINDACHNER, Ichth. Notizen, VII, 5, 1868, Mazatlan; JORDAN & GILBERT, Proc. U. S. Nat. Mus., 1881, 46; JORDAN & GILBERT, Synopsis, 536, 1883; EVERMANN & JENKINS, Proc. U. S. Nat. Mus., 1891, 142; BOULENGER, Cat., I, 281.

*Serranus acanthophorus*, BOCOURT, Ann. Sci. Nat., X, 1870, 223, west coast of Mexico. (Coll. Bocourt.)

*Paralabrax maculatofasciatus*, JORDAN & EIGENMANN, *l. c.*, 388, 1890.

### 1584. PARALABRAX HUMERALIS (Cuvier & Valenciennes).

Head 2¾ to 3¼ in length; depth 3⅙ to 4. D. X, 14; A. III, 7; scales 13 to 18–85 to 100–32, pores 64 to 70; about 32 scales before dorsal. Body robust; canines small; snout 3⅙ in head; eye 5½; least width of preorbital 6 in head; interorbital gently convex; the scales usually beginning opposite last part of pupil; maxillary $2\frac{1}{3}$ in head; nostrils small, subequal; gill rakers 9 + 19; first dorsal spine short, second $\frac{1}{3}$ longer, third more than 3 times second, fourth still longer (in specimens examined by us 2 to $2\frac{3}{5}$ in head, not longer than third in other specimens, according to authors), the fin thus very deeply notched; anal spines short, the second about equal to third, $4\frac{3}{5}$ in head; caudal lunate; pectoral $1\frac{1}{2}$ to $1\frac{2}{3}$ in head, the middle rays longest. Color in alcohol: Dark above, abruptly pale below; a large, dark, oblique dash below eye covering most of cheek; a row of 5 oblong, horizontal, white blotches just below lateral line, first and second largest, about as long as eye, a single one as large as third blotch above this row below the second to fourth rays of soft dorsal; caudal dusky, its central and posterior part pale; anal and ventral black; pectoral pale; spinous dorsal dusky at base; soft dorsal mottled with dark. Young (*humeralis*) with rather faint, dark bars and round, pale spots on head and ventral fins. Length 2 to 3 feet. Pacific Coast of South America from Panama to Juan Fernandez. According to Dr. Steindachner this handsome species is quite common in the deep channels separating the Galapagos Islands from each other. Here described from No. 10222, M. C. Z., 2 feet long, from Indefatigable Island, representing the form called *albomaculatus*, of which *humeralis* is regarded by Dr. Boulenger as the young. (*humeralis*, pertaining to the shoulder.)

*Serranus humeralis*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., II, 246, 1828, Chili; GÜNTHER, Cat., I, 104, 1859; BOULENGER, Cat., I, 278.

*Serranus semifasciatus* (Guichenot), GAY, Hist. Chile, II, 151, pl. 1, bis. fig. 2, 1847, Juan Fernandez.

*Percichthys godeffroyi*, GÜNTHER, Journ. Mus. Godeffroy, i, II, 2, 1873, 97, Iquique, Peru.

*Serranus albomaculatus*, JENYNS, Zoöl. Beagle, Fishes, 3, pl. 2, 1840, Galapagos Archipelago; GÜNTHER, Cat., I, 105, 1859; STEINDACHNER, Ichth. Beiträge, IV, 4, 1875, pl. 1, fig. 2.

*Paralabrax albomaculatus*, JORDAN & BOLLMAN, Proc. U. S. Nat. Mus., 1889, 181; JORDAN & EIGENMANN, *l. c.*, 389, 1890.

*Paralabrax humeralis*, JORDAN & EIGENMANN, *l. c.*, 389.

### 1585. PARALABRAX CLATHRATUS (Girard).

(CABRILLA; ROCK BASS.)

Head 3; depth 3. D. X, 14; A III, 7; scales 14–90 to 100–30, 68 to 75 pores. Caudal slightly lunate, not forked; body elongate, more compressed than in related species; snout pointed; eye $1\frac{2}{3}$ in snout, $4\frac{1}{2}$ in head. Top of head mostly naked; a few scales on median line behind pupil; preorbital narrow, not so broad as maxillary, less than half width of eye; maxillary $2\frac{2}{5}$ in head, broad at top; gill rakers rather long, x + 20 to 24; third, fourth, and fifth dorsal spines about equal, the third twice the second, 2 in head; second anal spine longer than third; pectoral long, $1\frac{1}{2}$ in head; ventrals $1\frac{3}{4}$; caudal fin slightly lunate. Color grayish green, with obscure, broad, dusky streaks and bars, which form reticulations on the sides; sides often shaded and mottled with bluish and greenish, but usually without distinct spots; a broad, dark, longitudinal shade near axis of body; belly plain silvery gray. Coast of southern California, from San Francisco to the Cerros Islands; the most common species of

*Paralabrax* on the California Coast; an excellent food-fish, reaching a weight of nearly five pounds and length of 18 inches. Here described from San Diego specimens. (*clathratus*, latticed, from the lattice-like markings, from κλῇθρον, a bar.)

*Labrax clathratus*, Girard, Proc. Ac. Nat. Sci. Phila., 1854, 143, San Diego.

*Paralabrax clathratus*, Girard, Proc. Ac. Nat. Sci. Phila., 131, 1856; Girard, Pac. R. R. Survey, 34, 1858, pl. xii, fig. 5; Günther, Cat., i, 63, 1859.

*Atractoperca clathrata*, Gill, Proc. Ac. Nat. Sci. Phila., 1861, 164.

*Serranus clathratus*, Steindachner, Ichth. Beiträge, iii, 1, 1875; Jordan & Gilbert, Proc. U. S. Nat. Mus., 456, 1880; Jordan & Gilbert, Synopsis, 535, 1883; Boulenger, Cat., i, 279.

*Paralabrax clathratus*, Jordan & Eigenmann, *l. c.*, 390, 1890.

## 509. CENTROPRISTES, Cuvier.

### (Black Sea Bass.)

*Centropristes*, Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 36, 1829, (*nigricans*).

*Centropristis*, Cuvier, Règne Animal, Ed. ii, 2, 145, 1829 (*nigricans*).

*Triloburus*, Gill, Cat. Fish. East. Coast U. S., 30, 1861, (name only; *trifurca*).

Body robust, somewhat compressed, covered with rather large ctenoid scales. Mouth large, formed as in *Serranus* and *Paralabrax*, the canines small. Tongue smooth. Preopercle serrate, the lower teeth somewhat antrorse. Gill rakers rather long and slender. Supraoccipital and parietals with strong crests extending forward to between postfrontal processes; frontals posteriorly with an angular transverse ridge in front of supraoccipital connecting the parietal crests; posterior processes of premaxillaries not reaching frontals. The characteristic smooth area on top of cranium very short and small. Dorsal short, its rays X, 11; anal rays III, 7; caudal usually 3-lobed or double concave; the canines very weak and the top of the head naked. The ventrals as in *Prionodes*, close together and inserted in advance of axil of pectoral; pectoral with 19 rays, its upper half truncate behind. The three species of *Centropristes* are closely related. (κέντρον, spine; πρίστης, saw.)

Centropristes:

- *a.* Dorsal spines with dermal flaps, which scarcely project beyond the tip of the spine; longest dorsal spine less than half length of head.
  - *b.* Caudal fin more or less rounded; coloration in alcohol uniform; scales 5–50–13. rufus, 1586.
  - *bb.* Caudal fin with its angles little produced, the longest ray not exserted for a distance equal to the length of the fin; gill rakers x + 18; scales on cheek in more than 7 rows; dorsal spines rather strong, the middle ones rather higher than the posterior, which are lower than the soft rays; highest dorsal spine 2 in head; none of the spines filamentous; color dusky brown or black, with paler longitudinal streaks; dorsal with oblique light and dark stripes; young with a black longitudinal band, many dark cross shades, and a large black spot on last dorsal spines. Sexes notably different, the fin rays longer in the male. striatus, 1587.
  - *bbb.* Caudal fin with its upper and lower lobes filamentous, much produced, the middle rays still longer, length of longest ray in the adult 2 in body; gill rakers about x + 12; scales on cheek in 7 rows; color grayish, each side with 3 longitudinal rows of quadrate black blotches, the upper series obscure, the second from eye below the lateral line to caudal quite distinct, the third series composed of shorter spots on a level with the lower half of the pectorals; some jet-black

spots about opercle and above axil; dorsal with a series of jet-black spots along its base; caudal with the middle rays black at their tips, the outer pale; jet-black spots on middle rays. OCYURUS, 1588.

TRILOBURUS (τρεῖς, three; λοβός, lobe; οὐρά, tail):

*aa.* Dorsal spines, or some of them, tipped with fleshy filaments, which project considerably beyond the tip of the spine; longest dorsal spine about half length of head; caudal lobes more or less produced.

*c.* Body rather elongate, little compressed, the anterior profile nearly straight; eye large, as long as snout, about 4 in head; mouth large, the lower jaw projecting; 10 rows of scales on cheek; dorsal spines slender, graduated rapidly to the third or fourth, thence decreasing to the last; fourth dorsal spine 2 in head; color olive gray; sides with about 7 broad, diffuse, brown bars extending from back obliquely forward to level of pectorals; a large black spot on membrane of last dorsal spines; dorsal filaments scarlet; caudal with irregular cross rows of round brownish spots; other fins similarly marked. Sexes little different. PHILADELPHICUS, 1589.

## Subgenus CENTROPRISTES.

### 1586. CENTROPRISTES RUFUS, Cuvier & Valenciennes.

This species resembles very closely *Centropristes striatus* in all respects, the only difference that we can detect being that the caudal fin is quite regularly rounded instead of trilobate. Fourth dorsal spine longest, 2 in head. Scales 5–50–13. Eye 4½ in head. Pectorals extending beyond ventrals, 1½ in head. Color uniform dark—in alcohol. Known only from the original types, two specimens in fair condition, from Martinique, in the museum at Paris. The species is a doubtful one and its characters need verification. (*rufus*, reddish.)

*Centropristes rufus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., III, 47, 1829, Martinique. (Coll. Plée.)

### 1587. CENTROPRISTES STRIATUS* (Linnæus).

(BLACK SEA BASS; BLACKFISH; TALLY-WAG; HANNAHILL; BLACK WILL; BLACK HARRY.)

Head 2⅔; depth 2⅔ to 3. D. X, 11; A. III, 7; scales 5–55 to 60–16 to 20, pores 50 to 55. Body robust, the back somewhat elevated anteriorly; head large, thick, little compressed; top of head naked; eye large, nearly 5 in head; mouth oblique, low, rather large; lower jaw projecting; maxillary broad, 2¼ in head; teeth in broad bands, the canines small, none of the teeth movable; gill rakers long, about x+18 developed; scales on cheek in about 11 rows; posterior border of preopercle finely serrate, the angle and lower border with larger teeth, some of them turned forward; maxillary slipping anteriorly under the edge of the preorbital, which is as broad as the eye; dorsal spines rather strong, the middle ones rather higher than the posterior, which are lower than the soft rays; highest dorsal spine 2 in head; none of the spines filamentous, but provided with short, lateral dermal flaps; pectorals very long, 1¼ in head; ventrals scarcely shorter; anal spines graduated; caudal slightly double

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*Dr. Holbrook has maintained that the northern form of this fish (*striatus* = *furvus* = *nigricans*) is distinct from the southern *atrarius*. The northern form (*striatus*) is said to have the air bladder simple and the pectoral fin as long as the ventrals. In the southern fish (*atrarius*), the air bladder is sacculated and the pectoral longer than the ventral. We do not find that these differences exist.

concave, with its angles little produced, the longest ray not exserted for a distance equal to the length of the fin. Color dusky brown or black, more or less mottled, and with paler longitudinal streaks along the rows of scales; dorsal with several series of elongate whitish spots forming oblique light stripes; other fins dusky, mottled; young with a black longitudinal band, which later breaks up, forming dark cross shades; a large black spot on last dorsal spines. Sexes notably different, the fin rays longer in the male, which approaches the male of *Centropristes ocyurus*. Pyloric cœca 4 to 7. Length 18 inches. Atlantic Coast of United States, Cape Ann to northern Florida; common northward; one of the common food-fishes of our Atlantic Coast, reaching a weight of about 3 pounds; its flesh excellent. (*striatus*, striped.)

*Labrus striatus*, LINNÆUS, Syst. Nat., Ed. x, 1758, 285, "America," (description very brief, but not to be referred to any other fish).

*Perca atraria*, LINNÆUS, Syst. Nat., Ed. XII, 485, 1766, Carolina. (Coll. Dr. Garden.)

*Blackfish*, SCHÖPF, Schriften der Naturforsch. Freunde, Berlin, VIII, 164, 1788, New York.

*Perca furva*, WALBAUM, Artedi Piscium, 336, 1792, New York (after Blackfish of SCHÖPF).

*Coryphœna nigrescens*, BLOCH & SCHNEIDER, Syst. Ichth., 297, 1801, New York.

*Lutjanus trilobus*, LACÉPÈDE, Hist. Nat. Poiss., IV, 246, 1802, locality unknown.

*Perca varia*, MITCHILL, Report Fishes N. Y., 415, pl. 3, fig. 6, 1815, New York.

*Centropristes nigricans*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., III, 37, pl. 44, 1829, New York.

*Serranus nigrescens*, JORDAN & GILBERT, Synopsis, 917, 1883.

*Centropristis atrarius*, GÜNTHER, Cat., I, 86, 1859; HOLBROOK, Ichth. S. Carolina, 42, 1860; BOULENGER, Cat., I, 303.

*Serranus atrarius*, JORDAN & GILBERT, Synopsis, 533, 1883; JORDAN & SWAIN, Proc. U. S. Nat. Mus., 231, 1884.

*Serranus furvus*, JORDAN, Proc. U. S. Nat. Mus., 546, 1884.

*Centropristis striatus*, JORDAN & EIGENMANN, *l. c.*, 391, plate 64, 1890.

### 1588. CENTROPRISTES OCYURUS (Jordan & Evermann).

Head 2¾; depth 3. D. X, 11; A. III, 7; scales 5 or 6–50–14. Dorsal spines not filamentous, the longest 2½ in head; pectorals 1⅖ in head, reaching a little past tips of ventrals. Scales on cheeks little larger than in *C. striatus*, in about 7 rows. Serræ of preopercle smaller than in *C. striatus*. Gill rakers shorter and farther apart than in *Centropristes striatus*, only 11 or 12 developed. Color pale olive, somewhat darker on the back; each side with 3 longitudinal rows of quadrate black blotches; the uppermost series obscure, along base of dorsal fin; the second distinct, and placed just below lateral line, the three anterior blotches of this series somewhat confluent; the lower series very distinct jet black, and not confluent, placed along side of belly, on the level of the axil of the pectoral. The blotches in each series correspond in position to those in the other series, so that, with dusky shades extending from one to another, they form about 7 dusky cross bands; some dark inky spots on opercle and above base of pectoral; opercle and preopercle with dusky shades. Chin with some dusky; spinous dorsal plain; soft dorsal with fine oblique bars on a pale ground, 2 of the dark blotches on body extending on its base; last ray with 2 or 3 dark spots. Caudal fin with the middle rays black, the outer pale, all of them with darker spots which become black on the median rays; anal fin pale, slightly mottled, the tips of its rays dusky; ventrals dusky; pectorals entirely pale; caudal fin with its upper and lower lobes filamentous, much produced, the middle rays still longer, exserted for a distance nearly equal to $\frac{2}{3}$ length of head, the total length of the longest ray being half the length of the body. Gulf of Mexico, in rather deep water; known from the Snapper Banks off Pensacola. In spite of the striking differences in color, in which this species considerably resembles the very young of *Centropristes striatus*, the details of form and structure are almost identical in the two species, the most notable difference being in the gill rakers. Here described from the type, $10\frac{1}{4}$ inches in length. (*ὠκύς*, swift; *οὐρά*, tail.)

*Serranus trifurcus*, JORDAN & GILBERT, Synopsis, 534, 1883; not *Perca trifurca*, LINNÆUS.
*Serranus ocyurus*, JORDAN & EVERMANN, Proc. U. S. Nat. Mus., 468, 1886, Snapper Banks off Pensacola. (Type, No. 37997. Coll. Silas Stearns.)
*Centropristis ocyurus*, JORDAN & EIGENMANN, *l. c.*, 392, 1890.

## Subgenus TRILOBURUS, Gill.

### 1589. CENTROPRISTES PHILADELPHICUS (Linnæus).

(ROCK SEA BASS.)

Head $2\frac{2}{3}$ to $2\frac{4}{5}$; depth $3\frac{1}{3}$ to $3\frac{2}{3}$. D. X, 11; A. III, 7; P. 17; C. 18; scales 5–52 to 55, 15 pores. Maxillary reaching posterior margin of pupil, $2\frac{1}{4}$ in head; mandibular band of teeth becoming a single series laterally; a few inner teeth in the front of each jaw enlarged; lower jaw with the inner series laterally and the outer series anteriorly of enlarged conical teeth, the lateral teeth but little larger than those in front; outer series of upper jaw much enlarged, becoming smaller laterally, those in front larger than any in lower jaw; patch on vomer crescent-shaped; on palatines long and narrow. Head naked forward from occiput, including suborbital ring, snout, preorbital, top of head, maxillary, and lower jaw; scales on cheeks small, in 9 to 11 very regular oblique series; scales on opercles as large as those on body, in 8 or 9 oblique series, those on the flap again smaller; least interorbital width about $\frac{4}{7}$ diameter of eye, which is $4\frac{3}{4}$ in head; serræ on and below preopercular angle slightly enlarged and more distant than those above; subopercle and interopercle finely, evenly serrate. Gill rakers $\frac{1}{2}$ length of eye, 3 + 10 in number. First 2 dorsal spines short, the third and fourth nearly equal, the fourth $\frac{1}{2}$ or nearly $\frac{1}{2}$ head; the last spines are then much shortened, forming a notch, the last spine $3\frac{2}{5}$ in head, $\frac{2}{3}$ the ray following; membrane deeply incised between the spines, the upper angles produced beyond the spines in long, narrow filaments, very variable in length, usually less than diameter of orbit; the spines themselves are acute;* the structure of the dorsal thus does not differ from that of *Centropristes striatus*, which has also a trifurcate tail. Caudal with the upper and middle rays much produced and nearly equal, the lower lobe but little lengthened; median rays nearly as long as head ($\frac{7}{8}$ to $\frac{11}{12}$), the lower rays about $\frac{2}{3}$ head. A young specimen, 5 inches long, has caudal nearly evenly convex behind, with the upper rays only slightly projecting. Anal spines short, graduated, the second the strongest, the third slightly longer, about ¼ head; longest rays nearly ½ head; middle ventral rays longest, not nearly reaching vent, 4/7 head; pectoral subtruncate, reaching vent, 1⅖ in head. Scales very strongly ctenoid, running well up on caudal fin and on membranes of soft dorsal, anal, and ventrals. Color in life: Olivaceous above, whitish below; 7 broad brown bars from back obliquely forward to level of middle of pectorals, these almost obsolete along lateral line; the color of the bars is not intense and is formed by shadings along the base and margins of the scales; the anterior bar crosses the nape and is very indistinct; snout and upper part of head with numerous brownish-red spots and lines, 3 or 4 of these parallel and running from eye to snout, the interspace usually light blue; upper lip reddish brown; tip of lower jaw broadly purplish; a dark blotch on opercle anteriorly and sometimes a small, dark spot behind eye; lining of opercle and throat lemon yellow; a large jet-black blotch behind pseudobranchiæ; spinous dorsal translucent, with indistinct whitish and dusky longitudinal streaks; a large blackish blotch on membrane of last spines immediately above fourth vertical bar of sides; some dark spots on the spines form 2 irregular lengthwise series; dorsal filaments bright scarlet, the fin usually with light-bluish shading; soft dorsal with a series of bluish-white spots near margin (1 between each 2 rays), 1 or more incomplete series above and below this; the fin is margined with reddish brown, and has usually several series of reddish-brown spots, these most numerous posteriorly; some irregular olive-brown spots toward base; a small black spot on base of membrane between eighth and ninth and 1 between tenth and eleventh rays, the former frequently absent; caudal translucent, with irregular cross series of round brownish-red spots, the space between them often with bluish-white spots; the fin margined above with brownish red; lower lobe whitish, unspotted; anal white, with a median sulphur-yellow streak and a terminal dark bar; ventrals whitish, with dusky areas, often uniform blackish; pectorals translucent; peritoneum silvery. Sexes similar. Rocky shores of South Carolina, in rather deep water; not yet seen elsewhere, but not rare at Charleston, where the specimen, 9½ inches long, above described, was taken by Dr. Gilbert. (*Philadelphicus*, from the city of Philadelphia, where the species is not found.)

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*Not at all filamentous, as figured by Holbrook (Ichth. S. C., pl. 7, fig. 1).

*Perca philadelphica*, Linnæus, Syst. Nat., Ed. x, 1758, 291, America.
*Perca trifurca*, Linnæus, Syst. Nat., Ed. xii, 489, 1766, Carolina. (Coll. Dr. Garden.)
*Lutjanus tridens*, Lacépède, Hist. Nat. Poiss., iv, 246, 1802, Carolina.
*Centropristis tridens*, Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 43, 1829.
*Centropristis trifurcus*, Holbrook, Ichth. S. Carolina, 49, pl. 7, fig. 1, 1860.
*Anthias trifurcus*, Günther, Cat., i, 91, 1859.
*Serranus philadelphicus*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 600.
*Serranus trifurcus*, Jordan & Gilbert, Synopsis, 534, 1883.
*Centropristis philadelphicus*, Jordan & Eigenmann, *l. c.*, 393, 1890.
*Centropristes trifurca*, Boulenger, Cat., i, 304.

## 510. DIPLECTRUM, Holbrook.

(SQUIRREL-FISHES.)

*Diplectrum*, HOLBROOK, Ichthyology of South Carolina, Ed. 1, 32, 1856, (*fascicularis* = *formosus*).
*Haliperca*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 236, (*bivittatus* = *radialis*, and other species; restricted to *bivittatus* by JORDAN & GILBERT, Synopsis, 535).
*Paraserranus*, BLEEKER, Verh. Akad. Amst., XIV, 1873, 6, (*hasselti*).

This genus is very close to *Prionodes*, from which it differs chiefly in the armature of the preopercle, which is provided in the adult with 1 or 2 clusters of strong, straight, divergent spines. Smooth area on top of head, as in *Serranus*, large, extending backward to a line connecting borders of preopercle; the supraoccipital and parietal crests very short; preorbital broad; maxillary widest before its tip; profile of snout rounded; pectoral unsymmetrically rounded, its upper rays longest; ventrals inserted * somewhat before axil of pectoral; dorsal spines slender, none of them much elevated; soft dorsal short, the rays X, 12; anal rays III, 7; caudal lunate. Species all American, of small size and bright colors. (δίς, two; πλῆκτρον, spur.)

HALIPERCA (ἅλς, sea; πέρκη, perch):

*a.* Preopercle with a single center of divergence of the spinules about its angle (in the adult as well as in the young).

*b.* Gill rakers very long, slender, and numerous, about 25 below angle of arch; scales on cheek in 7 or 8 rows; preopercular process narrow and truncate, its width about ¼ head; no black within gill cover; a pale-blue streak below orbit; about 18 scales before dorsal; head with opercular flap about 3 in body. SCIURUS, 1590.

*bb.* Gill rakers moderate, about 10 below angle of arch; spines on produced portion of preopercle numerous, 8 to 20 in number; outline of the spinous dorsal fin somewhat convex, so that the fin is more deeply notched than in *Diplectrum formosum*; jaws equal; vertex naked; opercle black within.

*c.* Scales on cheeks small and regularly placed, in about 10 rows; 22 scales before dorsal; head short, with opercular flap about 3 in body; width of preopercular process 4½ to 5 in head, its posterior edge rounded; gill rakers x + 10, short and slender, well separated; region above the large eye prominent; snout short, bluntish; cheeks with 10 rows of scales; these regularly placed; serræ on preopercle much produced in the adult, short in the young; upper lobe of caudal little produced. Color light brown above, dull yellowish below; the scales on sides each with a silvery center; irregular, vague, dark cross bars, broader than the interspaces; a black bar at base of caudal; usually no blue lines or white areas on head; soft dorsal with bright-blue spots, each surrounded by a dark-blue ring; caudal with bars of similar spots; young with 2 black longitudinal stripes, the lower forming a spot at base of caudal. RADIALE, 1591.

*cc.* Scales on cheek large, irregular, in 5 or 6 rows; head larger; soft dorsal pale below, mottled above, without distinct blue spots; 15 to 17 scales before dorsal.

*d.* Head moderate, 2⅔ in total length, with opercular flap; width of preopercular process ¼ head, its posterior edge truncated; upper edge of preopercle nearer tip of opercular flap than snout; brownish, with numerous traces of vague, dark cross bars; a very distinct black caudal spot; snout with 4 or 5 pale blotches; a pale streak from below eye across preopercular angle; no black at base of soft dorsal, the fin with very faint traces of blue spots. MACROPOMA, 1592.

*dd.* Head very large, 2⅓ to 2½ in total length (with opercular flap); upper angle of preopercle midway between tip of snout and tip of opercular flap; preopercular process very broad; soft dorsal dark at base. EURYPLECTRUM, 1593.

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* Essentially as in *Centropristes*, not as in *Serranus*, in which these species are placed by Dr. Boulenger.

DIPLECTRUM:

*aa.* Preopercle with 2 clusters of divergent spines, the one at the angle, the other higher (the two fascicles well separated in the adult, but smaller and coalescent in the young).

*e.* Head and body marked with many interrupted blue lines; preorbital broad, more than twice the width of maxillary; lower half of preopercle with strong, straight spines diverging from two centers; gill rakers short and small, x + 14; 11 rows of scales on cheeks; caudal deeply lunate, the upper lobe the longer, sometimes ending in a long filament. Color brownish, silvery below; sides with 7 or 8 longitudinal deep-blue lines and about as many dark cross bars, the last bar forming a large black blotch at upper base of caudal; young with 2 broad, dusky longitudinal stripes, which become interrupted with age; 3 or 4 distinct blue stripes on sides of top of head; 2 across preorbital, the lower forked; fins with narrow, wavy bars of blue and pale yellow. FORMOSUM, 1594.

## Subgenus HALIPERCA, Gill.

### 1590. DIPLECTRUM SCIURUS, Gilbert.

Head 2⅘ to 3 in length; depth 3⅘ (in specimens 5 inches long). D. X, 12; A. III, 8. Scales on cheeks small, in 7 or 8 rather regular rows. Lateral line with about 52 pores, about 75 vertical rows of scales above it; about 18 scales before dorsal. A single rather wide cluster of spines at angle of preopercle, much as in *Diplectrum macropoma*, the width of the cluster 4⅓ to 5 in head, in specimens 5 inches long. Upper angle of preopercle nearer to end of opercular flap than tip of snout. Vertical fins low, the height of soft dorsal ⅓ length of head. Gill rakers long and slender, about 14 + 25. In color this species differs from its near relatives in having no black on the inside of gill cover, and in having a very light blue line below the orbit; the snout is without spots or streaks; the upper part of body is crossed with irregular dusky bars, and the soft dorsal and caudal are marked with round yellow spots half as large as the pupil, ocellated with blue or dusky. Known from small specimens taken in considerable numbers, at stations 3014, 3015, 3021, 3026, and 3033, all in shallow water in the Gulf of California. This species most resembles *Diplectrum macropoma*, differing strongly from this and all other species of the genus in the very numerous long and slender gill rakers, which are ⅔ the diameter of the eye, even in young specimens; they are about 25 in number on the horizontal limb of the outer arch, instead of 12 as in *radiale* and *macropoma*, or 9 as in *formosum*. (Gilbert.) (*Sciurus*, squirrel; the name squirrel-fish has been long applied to *Diplectrum formosum*, perhaps from a croaking noise it makes.)

*Diplectrum sciurus*, GILBERT, Proc. U. S. Nat. Mus., 1891, 550, Gulf of California, Albatross Stations, Nos. 3014, 3021, 3026, and 3033. (Coll. Albatross.)
*Serranus sciurus*, BOULENGER, Cat., I, 298.

### 1591. DIPLECTRUM RADIALE (Quoy & Gaimard).

(AGUAVINA.)

Head 3; depth 3⅓. D. X, 12; A. III, 7; scales 8–60 to 70–20, 48 to 55 pores. Scales on cheeks small and regularly placed in about 10 rows; width of preopercular process 4½ to 5 in head, its posterior edge rounded;

gill rakers 6 + 13 or 14 with 4 or 5 rudimentary ones on upper angle, slender, well separated; region above the large eye prominent; snout short, bluntish, as long as eye, 4 in head; cheeks with about 10 rows of scales, regularly placed, about 22 scales before dorsal; serræ on preopercle much produced in the adult, short in the young, its upper angle nearer to end of opercular flap than tip of snout; upper lobe of caudal little produced; longest dorsal spine 2⅔ in head; anal spines feeble, graduated. Coloration of body light brown above, yellowish below; sides salmon color, much shading of cherry red on head and fins in life; head with greenish streaks; the scales on sides each with a silvery center; irregular, vague, dark cross bars broader than the interspaces; a black bar at base of caudal; usually no blue lines or white areas on head; soft dorsal with bright-blue spots, each surrounded by a dark-blue ring; caudal with bars of similar spots; young with 2 black longitudinal stripes, the lower forming a spot at base of caudal. Both coasts of tropical America, north to Havana and Guaymas; very common on the coast of Brazil and in the Gulf of California; found in shallow bays; our specimens from Guaymas, Mazatlan, Panama, Sambaia, Rio Janeiro, and Havana. (*radialis*, radiant, from the radiating preopercular spines.)

*Serranus radialis*, Quoy & Gaimard, Voyage Uranie, 316, 1824, Rio Janeiro; Cuvier & Valenciennes, Hist. Nat. Poiss., II, 243, 1828; Boulenger, Cat., I, 297.

*Serranus bivittatus*, Cuvier & Valenciennes, Hist. Nat. Poiss., II, 241, 1828, Martinique.

*Centropristes ayresi*,* Steindachner, Ichth. Notizen, VII, 1, 1868, pl. I, fig. 1, Santos, Brazil.

*Paraserranus hasselti*, Bleeker, Verh. Akad. Amst., XIV, 1873, No. 2, 7.

*Centropristis radialis*, Günther, Cat., I, 83, 1859; Steindachner, Ichth. Beiträge, IV, 6, 1875.

*Haliperca bivittata*, Poey, Synopsis, 282, 1868; Poey, Enumeratio, 22, 1875.

*Diplectrum radialis*, Streets, Bull. U. S. Nat. Mus., VII, 52, 1877; Jordan & Eigenmann, *l. c.*, 398, 1890; Evermann & Jenkins, Proc. U. S. Nat. Mus., 1891, 142.

*Centropristis bivittatus*, Günther, Cat., I, 82, 1859.

### 1592. DIPLECTRUM MACROPOMA (Günther).

Head 3⅕; depth 3⅓. D. X, 12; A. III, 7; scales 5–48–14. Snout 4 in head; eye 4. General form of body and head essentially as in *D. radiale*. Produced portion of preopercle not very broad; its (vertical) breadth not more than ¼ length of head. Scales on cheeks large and irregular, in 5 or 6 rows; about 15 scales before dorsal; width of preopercular process about ¼ head, its posterior edge truncated; gill rakers x + 10; longest dorsal spine 2¾ in head. Coloration brownish, with numerous traces of vague, dark cross bars; a very distinct black caudal spot; snout with 4 or 5 pale blotches; a pale streak from below eye across preopercular angle; no black at base of soft dorsal, the fin with very faint traces of blue spots; caudal plain, darker toward tip; ventrals pale. Pacific Coast of tropical America, in rather deep water, from Panama southward; abundant; here described from specimens dredged by the *Albatross*. (μακρός, large; πῶμα, opercle.)

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* Dr. Steindachner has already noted the identity of his *Centropristes ayresi* from Santos, Brazil, with *Diplectrum radiale*. With Dr. Steindachner, we find no difference between Atlantic and Pacific examples of this type. *Serranus bivittatus* is merely the young of this species. Specimens sent to us from Cuba by Poey confirm this supposition, as they differ from *radiale* precisely as the young differs from the adult in *formosum*.

*Centropristis macropoma*, GÜNTHER, Proc. Zoöl. Soc. London, 1864, 145, Panama; GÜNTHER, Fishes Central America, 409, pl. LXV, 1869.

*Diplectrum macropoma*, JORDAN & BOLLMAN, Proc. U. S. Nat. Mus., 1889, 157; JORDAN & EIGENMANN, *l. c.*, 398, 1890.

### 1593. DIPLECTRUM EURYPLECTRUM, Jordan & Bollman.

Head (to end of opercular spine) $2\frac{2}{3}$ to $2\frac{3}{4}$; depth $3\frac{2}{5}$ to $3\frac{1}{2}$. D. X, 12; A. III, 8; scales 8–50 to 55–18. Body moderately elongate, heavy through shoulders; the back not much elevated; anterior profile convex, nearly straight above eyes; mouth large, maxillary reaching posterior border of eye, 2 in head; snout blunt, $3\frac{3}{4}$ in head; eye large, slightly shorter than snout, 4 in head. Interorbital space appearing slightly concave, $1\frac{2}{3}$ in eye. Teeth as in *D. radiale.* Preopercular process very wide, its width $1\frac{1}{4}$ times diameter of eye; spines long and slender, 15 to 20 developed; the lower angle not so strongly projecting as in *D. macropoma.* Opercular spine rather sharp, embedded. Opercular flap long and well rounded at the end; upper end of preopercle midway between tip of snout and opercular flap. Gill rakers rather long, stout as in other species, x + 12. Scales small, rather firm, smaller than in other species, 8 or 9 rows on cheeks; scales on opercle smaller than in *D. radiale* or *D. macropoma*, about 12 scales before dorsal. Dorsal spines weak, pungent, second $1\frac{3}{5}$ in third, fourth and fifth almost equal, $3\frac{1}{3}$ in head; first soft ray 3 in head, shorter than next the last; upper lobe of caudal longest, $1\frac{2}{5}$ to $1\frac{3}{5}$ in head, lower lobe $1\frac{2}{5}$ to $1\frac{4}{5}$ in head; first anal spine $1\frac{4}{5}$ in second, which is strongest and $1\frac{1}{2}$ in third, latter 5 in head; soft rays showing a convex margin, the longest $3\frac{6}{7}$ in head; pectorals broad, their posterior margin truncate-concave, their length $1\frac{5}{9}$ in head; ventrals $1\frac{5}{7}$ in head. Color brownish above, as in *D. radiale*, becoming more yellowish and silvery below; sides with about 5 pairs of interrupted black bars; a large black blotch at base of caudal; markings on preorbital and cheeks rather indistinct; a large black spot above preopercular angle on opercle; lips bluish; spinous dorsal dusky above; a small pale spot under tip of spines; soft dorsal plain olive, dark at base; inner rays of caudal tipped with dusky, a few lower rays pale; pectoral and anal pale; ventrals dusky. This species is known from numerous specimens dredged by the *Albatross* at stations 2795 and 2797, southwest of Panama, at a depth of 33 fathoms, and at station 2805 at a depth of $51\frac{1}{2}$ fathoms. The largest of these is about 7 inches long. This species and the preceding, of which we have examined many specimens, are well distinguished from *Diplectrum radiale*, with which Dr. Boulenger has united them. *Diplectrum macropoma* is in appearance, coloration, and in habit intermediate between the other two, but the characters of all are well marked. (*εὐρύς*, wide; *πλῆκτρον*, spur.)

*Diplectrum euryplectrum*, JORDAN & BOLLMAN, Proc. U. S. Nat. Mus., 1889, 157, Pacific Ocean, off coast of Colombia, from 8° 06′ 30″ N., 78° 51′ W., and 7° 57′ N., 78° 55′ W., 7° 56′ N., 79° 41′ 30″ W., stations 2797, 2795, 2805. (Type, No. 41141. Coll. Albatross.)

### Subgenus DIPLECTRUM.

### 1594. DIPLECTRUM FORMOSUM (Linnæus).

(SQUIRREL-FISH; SERRANO; SAND-FISH.)

Head 3; depth 3⅖. D. X, 12; A. III, 7; scales 9–80 to 90–22, pores 54 to 60. Body elongate, the profile strongly arched above eyes; mouth large, lower jaw slightly projecting; maxillary narrow, reaching middle of eye, 2⅕ in head; canine teeth small; eye placed high, shorter than snout, about 5 in head; preorbital broad, more than twice the width of maxillary; upper part of margin of preopercle finely serrate; preopercle with two clusters of divergent spines, the one at the angle, the other higher (the two fascicles well separated in the adult, but smaller and coalescent in the young); distance from opercular flap to upper end of preopercle 1½ in rest of head; opercular flap short and sharp; gill rakers moderate, x + 14 or 15; top of head and preorbital region naked; smooth area on top of cranium very convex; 11 rows of scales on cheeks; fins, except caudal, scaleless; 15 scales before dorsal; dorsal spines low and slender, the first three graduated, the rest subequal; caudal deeply lunate, the upper lobe the longer, sometimes ending in a long filament; anal spines very weak, the third longest, 1½ in eye; pectoral 1¾ in head. Color brownish, silvery below; sides with 7 or 8 longitudinal blue lines, bright blue above, pearly whitish below, and about as many dark cross bars, the last bar forming a large black blotch at upper base of caudal; 6 of these present, with another at base of dorsal; a broken median stripe before dorsal; stripes on head bright blue; spinous dorsal with 2 stripes of light blue, bordered with darker, and 3 of light orange yellow; 3 blue stripes and 4 yellow ones on soft dorsal; caudal with light-blue reticulations around light-orange spots; ventrals and anal bluish white, shaded with light yellowish; pectoral transparent; posterior part of mouth tinged with yellow;* young with 2 broad, dusky longitudinal stripes, which become interrupted with age; 3 or 4 distinct blue stripes on sides and top of head; 2 across preorbital, the lower forked; fins with narrow, wavy bars of blue and pale yellow. West Indies; common from Charleston south to Montevideo.† A handsome fish, common on the

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*A specimen obtained by Dr. Hugh M. Smith in Biscayne Bay, Florida, in February, had the following life colors: Body dull light brownish above, white below, marked by 8 rather broad dark cross bands, 3 or 4 longitudinal dark stripes, and 8 narrow blue longitudinal stripes most distinct above where they contrast with the dark back. Head yellow, 5 or 6 narrow wavy blue stripes on side of head below eye; head between eyes marked by 5 narrow blue cross bars running out on the nose; a dark spot at base of caudal; dorsal uniformly yellowish green, marked by 2 median cross lines of blue, same color as the back; the blue lines posteriorly forming small yellow ocelli; caudal same as dorsal as to color and markings; other fins white.

†We have examined specimens from Charleston, Pensacola, Key West, Captiva Key, Havana, Pernambuco, and Rio Janeiro. These specimens show no evident specific differences, but the differences due to age are somewhat considerable. The smallest specimens before us (2 inches long) have a very distinct dark lateral band running from the tip of the snout and ending in a dark spot at the upper base of caudal fin; another (paler) band runs from the upper part of eye to base of last dorsal rays; another from above eye along base of dorsal. These bands are sharply defined in the young, and traces of them are usually found in all examples. In the smallest specimens the preopercle is simply but coarsely serrate with a salient angle; in larger ones a portion of the preopercle is prolonged backward and its spines begin to radiate. In examples of 4 inches the spines are not yet divided into 2 fasciæ, but later they begin to show radiation from 2 distinct centers. In specimens of 7½ inches the 2 fascicles of spines are distinct. In the largest, the upper lobe of the caudal is filamentous.

South Atlantic and Gulf coasts of the United States on rocky or sandy shores. Length about a foot. (*formosus*, handsome.)

*Perca formosa*, LINNÆUS, Syst. Nat., Ed. XII, 488, 1766, Carolina (Coll. Dr. Garden); GMELIN, Syst. Nat., 1322, 1788 (copied), and of the copyists; partly confused with *Hæmulon plumieri*, to which species some of the early references belong.

*Epinephelus striatus*, BLOCH, Ichthyologia, pl. 330, 1793, Jamaica (not *Anthias striatus*, BLOCH, which is really an *Epinephelus*.)

*Serranus radians*, QUOY & GAIMARD, Voy. de l'Uranie, Poiss., 313, pl. 58, fig. 2, 1824, Montevideo (?); BOULENGER, Cat., I, 295.

*Serranus irradians*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., II, 244, 1828, Montevideo.

*Serranus fascicularis*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., II, 245, pl. 30, 1828, Brazil; also IX, 431, 1833; JORDAN & GILBERT, Synopsis, 534, 1883.

*Centropristis radians*, GÜNTHER, Cat., I, 83, 1859.

*Centropristis fascicularis*, GÜNTHER, Cat., I, 83, 1859.

*Diplectrum fasciculare*, HOLBROOK, Ichth. S. Carolina, 35, 1860; POEY, Synopsis, 282, 1868.

*Diplectrum radians*, POEY, Enumeratio, 23, 1875.

*Serranus formosus*, JORDAN, Proc. U. S. Nat. Mus., 1884, 35.

*Diplectrum formosum*, JORDAN & EIGENMANN, *l. c.*, 397, pl. 65, 1890.

## 511. PRIONODES, Jenyns.

### (SERRANOS.)

*Prionodes*, JENYNS, Voyage of the Beagle: Fishes, 46, 1840, (*fasciatus*).

*Mentiperca*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 236, (*luciopercanus*).

Body oblong, moderately compressed, covered with moderate-sized, ctenoid scales. Lateral line normal in direction, not running close to the back. Cranium above with a very large convex smooth area, which is longer than the low supraorbital crest; supraoccipital and parietal crests short, extending to a line connecting borders of the preopercle; posterior outline of cranium nearly vertical in profile; mouth large, the maxillary not scaly and without supplemental bone; canines small, lateral; no depressible teeth in jaws; teeth always present on vomer and palatines.* Gill rakers usually few. Branchiostegals 7. Dorsal with 10 rather slender spines, either subequal or one of them much produced; the fin not deeply notched, the soft portion short, of 11 to 13 rays and nearly or quite destitute of scales; anal short, with slender spines; caudal lunate or truncate. Ventrals not very close together, inserted somewhat in advance of pectorals, as in *Centropristes* and *Diplectrum*. Vertebræ 10 + 14 = 24. Species of small size, probably all American, closely allied to the Old World genus *Serranus*, from which they are distinguished by the short, naked, soft dorsal, the anterior insertion of the ventrals, and the smaller teeth. The type of *Serranus* (*Serranus cabrilla*) has the lateral line running very high, following the outline of the back. The subgenus *Serranellus* (*Serranus scriba*) is intermediate, having the long soft dorsal and strong dentition of *Serranus*, with the lateral line and general appearance of *Prionodes*, the ventral fins longer and closer together, and inserted much farther back; the skull is essentially similar in *Prionodes*, *Dules*, and *Serranus*. (*πρίων*, saw; *εἶδος*, resemblance, from the resemblance to *Serranus*—*serra*, saw.)

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* Not wanting, as stated by Jenyns, who perhaps had an injured or imperfect specimen.

PRIONODES:

*a.* Scales large, 42 to 55 in the lateral line.

*b.* Scales on cheek very large, in about 5 series; dorsal spines not quite equal, the fourth longest, about twice length of the ninth.

*c.* Teeth of jaws unusually small, the canines scarcely differentiated; lower teeth in one series; lower jaw little projecting.

*d.* Head long, 2⅓ in length; preorbital narrow, ¼ eye; angle of preopercle slightly projecting; vertex scaly, the serræ minute and equal; gill rakers long and slender, x + 16, the longest half eye; dorsal spines weak, flexible, low; caudal deeply lunate; pectorals long and narrow. Color dusky brownish, paler below, a series of about 7 ill-defined dusky blotches along lateral line; lining of opercle largely black, this appearing externally as a dusky blotch; vertical fins transparent, with minute dark specks; no sharp markings on body or fins. ÆQUIDENS, 1595.

*cc.* Teeth unusually strong, 3 or 4 on each side in upper jaw as large as the largest lateral teeth; jaws equal; preorbital extremely narrow, not ⅓ width of pupil; preopercle very sharply serrate; gill rakers short, slender, x + 10; caudal forked. Color plain olivaceous; fins all pale; sides with about 6 faint dark cross bands, more or less confluent along lateral line. FUSCULUS, 1596.

*bb.* Scales on cheek moderate, in about 8 series; body oblong, heavy anteriorly; dorsal outline a little elevated, the profile almost straight; eyes very large, as long as snout; lower jaw not projecting; canines small; mouth large; preorbital narrow; gill rakers short, about x + 10; dorsal spines strong, the fourth highest, 2¼ in head, a little longer than longest soft ray; dorsal fin not notched; soft dorsal a little scaly; caudal deeply lunate; pectorals long. Color light brownish, with lighter blotches and faint dusky bars; a very conspicuous, sharply defined, vertical white bar extending upward on each side from just before vent; fins pale. PHŒBE, 1597.

*bbb.* Scales on the cheek very small, in 10 to 12 series; second anal spine about as long as fourth dorsal spine. Body oblong, not elevated; snout sharp; lower jaw much projecting, its tip entering the profile; teeth rather strong; gill rakers short and few, x + 8. Dorsal continuous, the spines low, the longest 3 in head; caudal somewhat lunate. Color light olivaceous, with 12 irregular, broad, dark-brown bands extending to below the lateral line, appearing again at level of base of pectorals as a series of rounded blotches; two pale streaks or rows of blotches extending from snout through eye and backward; a broad brown streak from eye to upper angle of opercle; a dark spot at base of ventrals, one or more below base of pectorals, and one in front of the latter; caudal dark brown at base, reticulated with irregular, narrow, light-blue lines, these marks most distinct on outer rays; a large double blotch at base of caudal; anal and ventrals marked with brownish-yellow spots; upper part of soft dorsal sharply spotted with dark brown. FASCIATUS, 1598; BULLERI, 1599.

MENTIPERCA (*mentum*, chin; *perca*, perch):

*aa.* Scales small, the lateral line with 60 to 75 in its course.

*e.* Lower jaw not very strongly projecting.

*f.* Body covered with irregular, inky-black spots and bands. Body long and low, the head low and sharp, the lower jaw projecting; scales on cheek in 10 or 12 rows; teeth small; gill rakers very short, x + 7; dorsal low, not notched; caudal forked. Color brownish above, the sides yellowish, everywhere above, below, and on fins covered with irregular, inky-black spots, blotches, and bands, the latter meeting around the belly; pectorals and anal plain; a broad ring around base of caudal, and many irregular spots around bases of ventrals and pectorals; numerous black spots on dorsals and caudal, one of those on front of spinous dorsal very conspicuous. TIGRINUS, 1600.

*ff.* Body not covered with conspicuous, inky-black spots and bands.

*g.* Back with 3 or more large, conspicuous blotches of yellowish white. Body more elongate than in related species; lower jaw slightly projecting; scales on cheeks in 11 series; dorsal spines low, fifth the longest, 2¼ in head; caudal strongly lunate; pectorals and ventrals short. Color brownish red above, with areas of light yellow on sides of back; one before dorsal, a large one and a small one below spinous dorsal; a large one below last rays of soft dorsal; one on back of tail; top of head with 2 pale cross shades, one before, one behind eyes; lower fins light orange; caudal red, with 2 conspicuous longitudinal stripes of blackish red; dorsal red-shaded, a maroon blotch on each part of it, extending upward from a similar blotch on the back.

TABACARIUS, 1601.

*gg.* Back without conspicuous blotches of yellowish white.

*h.* Coloration nearly uniform; body elongate; snout short and thick; caudal slightly lunate. Color brownish yellow on back, orange on sides, and brighter or red on belly; no spots nor bands; upper part of head bluish, the fins gray; caudal bordered above and below with brown.

FLAVESCENS, 1602.

*ee.* Lower jaw very strongly projecting; body elongate, moderately compressed; scales small, about 70; snout sharp, much longer than the large eye; preopercle finely denticulated; top of head with vertex naked; caudal deeply forked; skull depressed, with a single crest; dorsal spines moderate, the third highest.

*i.* Color clear brown with larger darker spots or bars on the sides; fins pale, more or less tinged with orange. LUCIOPERCANUS, 1603.

*ii.* Color red, with numerous roundish inky-black spots behind, a large quadrate dark blotch on front of soft dorsal; lower half of caudal black; a large, oblong silver-white blotch from before vent, extending upward and backward.

STILBOSTIGMA, 1604.

## Subgenus PRIONODES.

### 1595. PRIONODES ÆQUIDENS (Gilbert).

Head 2⅓; depth 3½; eye large, as long as snout, 4½ in head. D. IX, I, 12; A. III, 7; scales 4½–48–13, 5 series on cheeks parallel with posterior margin of orbit. Body slender, the head very long, the caudal peduncle narrow. Tip of lower jaw but little projecting; mouth large, the maxillary reaching vertical from posterior margin of pupil, 2⅓ in head. Upper jaw with teeth laterally in a single series, becoming double anteriorly; the outer teeth are larger and spaced but not canine-like; the inner are close-set, small, directed inward; the median pair of teeth of inner series are larger than the others and directed backward. Teeth of lower jaw in a single series forming a very narrow patch at symphysis. Teeth in a narrow patch on vomer, the posterior enlarged, almost canine-like, directed backward; on palatines in an irregular double series. Interorbital space flat, its width ⅗ orbit. Preorbital narrow, ¼ orbit. Angle of preopercle slightly projecting, the vertical margin gently concave; teeth minute and equal on both limbs and at angle. Opercle greatly produced backward, reaching much beyond inner edge of shoulder girdle, the margin of preopercle equidistant between front of eye and end of opercular flap. Opercle with a single spine, the lower not developed. No spine on shoulder. Gill rakers long and slender, x + 16, the longest ½ the diameter of the large eye. Dorsal with weak, flexible, low spines, which increase in length to the fourth (2/7 length of head), then decrease to the ninth, which is less than ½ the fourth, the tenth again longer; dorsal rays slender, little forked, the longest less than highest spine. Caudal deeply lunate; anal short, with slender rays, the margin not rounded, the anterior rays longest, the posterior but little shortened; anal spines slender, graduated, the third scarcely ⅔ height of first soft ray; ventrals inserted well in advance of base of pectorals, not nearly reaching vent, ½ head; pectorals long and narrow, reaching front of anal, with narrow scaly base, the posterior margin obliquely truncate or somewhat *ƒ*-shaped in the spread fin, the lower rays slightly longer than upper, the middle rays shortest. Scales large, ctenoid, a wide rough area within the spinous margin; cheeks and opercles scaled, the scales on opercles larger than elsewhere; top of head scaled as far forward as posterior margin of pupil; caudal fin scaled at base of lobes; fins otherwise without scales; lateral line running high and descending gradually to middle of caudal peduncle. Color in spirits: Dusky brownish above, lighter below; a series of about 7 ill-defined dusky blotches along lateral line, from which still fainter bars run downward, soon disappearing; lining of opercle largely black; this apparent as a dusky blotch externally; vertical fins transparent, minutely punctate with black; median rays of ventrals black, the outer and inner whitish; peritoneum silvery white; no very conspicuous marks on body or fins. Gulf of California. A single specimen known, about 7 inches long, from Station 2996, in 112 fathoms. (*æquus*, equal; *dens*, tooth.)

*Serranus æquidens*, Gilbert, Proc. U. S. Nat. Mus., 1890, 61, Gulf of California, Albatross Station No. 2996 (Type, No. 44277); Jordan & Eigenmann, *l. c.*, 406; Boulenger, Cat., I, 291.

### 1596. PRIONODES FUSCULUS (Poey).

Head 2⅘; depth 3⅕. D. X, 12; A. III, 7; scales 48. Body rather elongate, little compressed; scales on cheeks very large, in about 5 series; teeth unusually strong, three or four on each side in upper jaw as large as the largest lateral teeth; eye very large, 2⅚ in head; maxillary 2⅕ in head; jaws equal; preorbital extremely narrow, not ⅓ width of pupil; preopercle very sharply serrate; gill rakers short, slender, x + 10; scales very large, covering head forward to back of pupil; first dorsal spine short, second a little longer; fourth longest, 2⅓ in head; the rest gradually shortened, lower than the soft rays, which are scaleless; second anal spine 4 in head, as long as third and stouter; caudal forked. Color plain olivaceous; fins all pale, no opercular blotch; sides with about 6 faint dark cross bands, more or less confluent along lateral line, and disappearing below. Cuba; known only from the original type, sent by Poey to the museum at Cambridge. From this specimen (10015, M. C. Z., 7 inches in length) our description is taken. (*fusculus*, somewhat tawny.)

*Centropristes fusculus*, Poey, Memorias, II, 342, 1861, Havana. (Coll. Poey.)
*Haliperca fuscula* Poey, Synopsis, 281, 1868.
*Serranus fusculus*, Jordan & Eigenmann, *l. c.*, 407, 1890; Boulenger, Cat., I, 290.

### 1597. PRIONODES PHŒBE (Poey).

(Phœbe).

Head 2⅘; depth 3¼. D. X, 12; A. III, 7; scales 5-53-15, pores 50 to 52. Body oblong, heavy anteriorly; dorsal outline a little elevated, the profile almost straight; eyes very large, as long as snout, 3⅓ in head, twice the concave interorbital space; scales on cheek moderate, in about eight series; top of head naked; lower jaw not projecting; canines small; mouth large, the maxillary reaching middle of eye; preorbital narrow; gill rakers short, x + 13; 12 rows of scales before dorsal; dorsal spines strong, the fourth highest, 2¼ in head, a little longer than longest soft ray; dorsal fin not notched; soft dorsal a little scaly; caudal deeply lunate; second anal spine 3½ in head, stronger but scarcely longer than third spine; pectorals long, reaching anal, as long as ventrals, 1¼ in head. Color light brownish, with lighter blotches and faint dusky bars; a very conspicuous, sharply defined, vertical white bar extending upward on each side from just before vent; fins pale. Length 8 inches. West Indies, north to Pensacola; rather common; our specimens of this species are from Havana and from the Snapper Banks off Florida. (*phœbe*, the moon, from the white lateral bar.)

*Serranus phœbe*, Poey, Memorias, I, 55, pl. 2, fig. 3, 1851, Havana; Jordan, Proc. U. S. Nat. Mus., 1884, 35; Jordan & Eigenmann, *l. c.*, 407, 1890.

*Centropristis phœbe*, Günther, Cat., I, 85, 1859.

*Haliperca phœbe*, Poey, Synopsis, 281, 1868.

### 1598. PRIONODES FASCIATUS, Jenyns.

Head 2⅚ to 3; depth 3⅓ to 3¼. D. X, 12; A. III, 7; scales 5–50–15, pores 49. Body elliptical, little elevated, the dorsal outline gently arched. Snout sharp; lower jaw distinctly longest; maxillary reaching vertical from middle of pupil, or beyond; interorbital space somewhat concave and ridged. Teeth small, cardiform; 2 small canines in front of lower jaw, 4 in front of upper jaw; the inner series of teeth somewhat enlarged, containing 2 or 3 large fixed canines in the middle of sides of lower jaw, these larger than the canines in front; strong teeth on vomer and palatines; no supplemental maxillary bone; gill rakers short, few in number, about 10 below angle; preopercle nearly evenly rounded, the posterior margin nearly vertical and, as well as the angle, very finely, evenly, and sharply serrated, the serræ on angle scarcely larger, the lower limb nearly entire; opercle ending in three compressed spines, the middle the largest, the membrane extending much beyond them. Scales well ctenoid, on cheeks small, in 9 to 11 rows; opercles with about 4 series of large scales; jaws and top of head naked. Spinous dorsal low, not notched, the first two spines shorter than the others, which are of equal length and shorter than the soft rays; length of spines about equaling distance from snout to middle of eye, 3 in head; soft dorsal elevated, the anterior rays somewhat shorter than the posterior, the tips of which reach rudimentary caudal rays, 2⅕ in head; anal spines short and strong, the middle one stronger and slightly longer than the third; the second about equal to dorsal spines; anal rays more elevated than those of dorsal, the last ray the longest and about equal to ⅔ length of head; ventrals reaching vent; pectorals slightly beyond it, ⅔ length of head; ventrals inserted in front of axil of pectorals; caudal short, somewhat lunate, with the outer rays produced, the fin 1⅖ in head; dorsal and anal scaleless. Branchiostegals 7. Color light olivaceous, the dorsal region with about 12 broad dark-brown cross bands extending from back to below lateral line, where they are interrupted, to reappear on the level of base of pectorals as a series of roundish blotches; those in front pinkish, behind brown; a light streak from nape to front of dorsal, with 2 parallel ones (usually indistinct) on each side of it; the brown bar immediately behind soft dorsal replaced by the ground color, but the corresponding brown spot on sides present; a brownish streak from snout through eye to upper angle of opercle, clear brown anteriorly; suborbital light blue, with a narrow median streak of clear brown; numerous clear brown blotches on top of head; base and axil of pectorals largely pink, the fin very finely vermiculated with pink and light blue; dorsals reddish, with a median light streak, which disappears posteriorly on soft dorsal; distal part of soft dorsal with numerous small dark-brown spots, becoming light pink posteriorly and alternating with similar spots of whitish or light blue; a dark-brown spot at base of ventrals; one below base of pectorals, and one in front of the latter at margin of gill opening; caudal brown at base and on outer rays, pink on inner rays, vermiculated with irregular narrow light-blue lines; anal and ventrals light glaucous blue, thickly marked with brownish-yellow spots. In older specimens the markings fainter, but the general pattern remains. A specimen 9 inches long, from Indefatigable Island, has the upper black bands coalescent into a continuous beaded streak from eye to last ray of dorsal, where it is interrupted to form again a black blotch at base of caudal above; a blotch at the base of pectoral and several black spots on breast, irregularly arranged. In this specimen the vomerine and palatine teeth are few, and covered with slime so as to be scarcely appreciable. Length, one foot.

Pacific Coast of Mexico, Cape San Lucas to Galapagos Islands; common about rocky places; a very handsome little fish. We have examined specimens of this species from Mazatlan, Pearl Islands (Panama), La Paz, from Charles, Hood, Albemarle, and Indefatigable islands, of the Galapagos, and from the Revillagigedos. (*fasciatus*, banded.)

*Prionodes fasciatus*,* Jenyns, Voy. Beagle, Fishes, 46, 1840, Chatham Island, Galapagos (Coll. Charles Darwin); Günther, Cat. Fish., I, 96, 1859 (not *Holocentrus fasciatus*, Bloch, which is *Serranus scriba*); Jordan, Proc. U. S. Nat. Mus., 1889, 81.

*Serranus psittacinus*, Valenciennes, Voyage Vénus, Poiss., 290, pl. I, fig. 1, 1855, Galapagos Islands.

*Serranus calopteryx*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 350, 1881, Mazatlan. (Type, No. 28123. Coll. Gilbert.)

*Centropristis psittacinus*, Günther, I, Cat., 186, 1859.

*Serranus psittacinus*, Jordan & Eigenmann, *l. c.*, 407, 1890; Boulenger, Cat., I, 295.

### 1599. PRIONODES BULLERI (Boulenger).

Head 3; depth 3. D. X, 12; A. III, 7; scales 5 to 6–52–15, pores 50; snout as long as diameter of eye, which is 4 times in length of head; interorbital width 5 times in length of head; lower jaw slightly projecting, with feeble canine teeth on the sides; maxillary extending to below center of eye, the width of its distal extremity ½ diameter of eye; snout and vertex naked, cheeks and opercles scaly, the scales on the opercles large, larger than any on the body, in 5 vertical series; preoperculum finely serrated, the serræ coarser at the angle, obsolete on the lower border; middle opercular spine strong, nearer lower than upper. Gill rakers moderate, 12 on lower part of the anterior arch. Dorsal originating above base of pectoral, the spines increasing in size to the fourth, which equals $\frac{2}{5}$ length of head and is a little shorter than the longest soft rays; no notch between the spinous and soft portions; pectoral obtusely pointed, slightly longer than ventrals, $\frac{3}{4}$ length of head; second and third anal spines equal, stouter and slightly shorter than longest dorsal; caudal slightly emarginate. Brown, with ill-defined darker vertical bars; soft dorsal, anal, and caudal with small dark and light spots; pectorals and ventrals yellowish. Length 6 inches. Coast of Jalisco, western Mexico.

*Serranus bulleri*, BOULENGER, Cat., I, 288, 1895, Las Peñas, Jalisco. (Coll. A. C. Buller.)

### Subgenus MENTIPERCA, Gill.

### 1600. PRIONODES TIGRINUS (Bloch).

Head $2\frac{5}{6}$; depth $3\frac{2}{3}$; eye 4 in head. D. X, 11; A. III, 7; scales 8–68–24, 60 pores. Body long and low, the head low and sharp, the lower jaw projecting; scales small; top of head naked, the smooth area on frontal region large; scales on cheek small, in 10 or 12 rows; preopercle rounded, with regular serræ; teeth small; gill rakers very short, x + 6 to 8; maxillary $2\frac{1}{2}$, reaching to center of eye; soft dorsal and anal naked; dorsal low, not notched; caudal forked; second and third anal spines equal, the second the strongest, $2\frac{1}{4}$ in head; pectoral $1\frac{1}{3}$ in head. Color brownish above, the sides yellowish, everywhere, above, below, and on fins covered with irregular, inky-black spots, blotches, and bands, the latter meeting around the belly; pectorals and anal plain; a broad ring around base of caudal, and many irregular spots around bases of ventrals and pectorals; numerous black spots on dorsals and caudal, one of those on front of spinous dorsal very conspicuous. West Indies; scarce; an exceedingly handsome little fish, here described from the original type of *Serranus præstigiator*, sent by Poey to the Museum of Comparative Zoölogy. (*tigrinus*, spotted like a tiger.)

*Holocentrus tigrinus*, BLOCH, pl. 237, 1790, after SEBA, Thesaurus, III, pl. XXVII, fig. 5, East Indies.

*Serranus præstigiator*, POEY, Memorias, I, 58, pl. 2, fig. 2, 1851, Havana. (Coll. Poey. Type in M. C. Z.)

? *Centropristes annularis*, GÜNTHER, Shore Fishes, Challenger, 6, pl. 1, fig. B, 1880, Pernambuco young specimen 2 inches long.

*Centropristis præstigiator*, GÜNTHER, Cat., I, 85, 1859.

*Haliperca præstigiator*, POEY, Synopsis, 282, 1868.

*Serranus tigrinus*, JORDAN, Proc. U. S. Nat. Mus., 1886, 579; JORDAN & EIGENMANN, *l. c.*, 408, 1890; BOULENGER, Cat., I, 293.

? *Serranus annularis*, JORDAN & EIGENMANN, *l. c.*, 406.

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* The earliest specific name of this species, *fasciatus*, can not be used if the species be referred to *Serranus*, as already more than one *Serranus* has been called *fasciatus*. The name is, however, not preoccupied in *Prionodes*. The genus *Prionodes* was supposed by Jenyns to differ from *Serranus* by the absence of vomerine and palatine teeth. These teeth are, as a matter of fact, well developed in the young, but in some old specimens they are small, partly covered by the skin, and possibly even deciduous. Renewed comparison shows that 1598*a*, *Prionodes bulleri* (Boulenger), is a distinct species, though close to *P. fasciatus*; the jaws shorter, the color dull.

### 1601. PRIONODES TABACARIUS (Cuvier & Valenciennes).

(JACOME; BOUT DE TABAC.)

Head 3; depth 3¾. D. X, 12; A. III, 7; scales 11–90 to 98–25, 56 to 65 pores. Body more elongate than in related species; profile slightly convex; interorbital space concave; eyes large, longer than snout, 3¼ in head; maxillary reaching middle of eye; lower jaw slightly projecting; scales on cheeks small, in 11 series; scales in front of dorsal small, crowded, in 25 series; top of head naked; gill rakers long, x + 15; dorsal spines low, fifth the longest, 2¼ in head; caudal strongly lunate; anal spines graduated, the third 3⅓ in head; pectorals and ventrals short, not reaching vent. Branchiostegals 7. Color brownish red above, with areas of light yellow on sides of back; 1 before dorsal, a large one and a small one below spinous dorsal; a large one below last rays of soft dorsal; 1 on back of tail; yellow before eye; belly and lower parts light red; top of head with 2 pale cross shades, 1 before and 1 behind eyes; lower fins light orange; caudal red, with 2 conspicuous longitudinal stripes of blackish red; dorsal red-shaded, a maroon blotch on each part of it, extending upward from a similar blotch on the back. Length 10 inches. West Indies; our specimens from Havana, where it is rather common. (*tabacarius*, pertaining to *tabacum*, tobacco, the fish being called *bout de tabac* (cigar stump) by the negroes at Martinique.)

*Centropristes tabacarius*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., III, 44, 1829, Martinique.
*Serranus jacome*, POEY, Memorias, I, 57, pl. 2, fig. 1, 1851, Havana.
*Haliperca tabacaria*, POEY, Synopsis, 282, 1868.
*Haliperca jacome*, POEY, Ann. Lyc. Nat. Hist. N. Y., 1871, 34.
*Serranus tabacarius*, JORDAN, Proc. U. S. Nat. Mus., 1886, 39; JORDAN & EIGENMANN, *l. c.*, 408, 1890; BOULENGER, Cat., I, 291.

### 1602. PRIONODES FLAVESCENS* (Cuvier & Valenciennes).

Dorsal IX†, 12; anal III, 7; scales 7–90–27, 60 pores. Depth of body 3¾ times in total length, length of head 3 times. Snout as long as diameter of eye, which is 3½ times in length of head; interorbital width 5 times in length of head; lower jaw projecting, with feeble canine teeth on the sides; maxillary extending to below center of eye, the width of the distal extremity ½ diameter of eye; upper surface of head naked; cheeks and opercles scaly; preoperculum finely serrated, the serræ coarser at the angle, obsolete on the lower border; opercular spine strong, equidistant. Gill rakers a little shorter than gill fringes, 14 on lower part of anterior arch. Dorsal originating above base of pectoral, spines subequal, not quite ⅓ length of head, ¾ length of longest soft rays; no notch between the spinous and soft portions of the fin. Pectoral rounded, a little longer than ventral, ⅔ length of head. Third anal spine longest, as long as dorsals. Caudal emarginate. Brown above, lighter (orange or red) on the belly; head bluish above; fins dark gray brown; caudal whitish in the middle. Total length 6½ inches. Martinique; known only from the type, the above description of which we copy from Boulenger. (*flavescens*, yellowish.)

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* Described from the type specimen (Paris Mus., No. 7028).

† The spinous dorsal is malformed in front; the normal number of spines is no doubt X.

*Serranus flavescens*, Cuvier & Valenciennes, Hist. Nat. Poiss., vi, 506, 1830, Martinique; Jordan & Figenmann, *l. c.*, 408, 1890; Boulenger, Cat., i, 292.

### 1603. PRIONODES LUCIOPERCANUS* (Poey).

Head 3 in length; depth 3¼. D. X, 12; A. III, 7; scales 7–70–20. Body elongate, moderately compressed; cranium depressed, with a single crest; snout sharp; lower jaw very strongly projecting; eye large, much shorter than snout; top of head naked; caudal deeply forked; dorsal spines moderate, the third highest. Color clear brown with larger, darker spots or bars on the sides; fins pale, more or less tinged with orange. Coast of Cuba, apparently very rare, only the original type known (at Cambridge) examined by us. (*luciopercanus*, resembling *Lucioperca*, the Pike Perch, a European genus of *Percidæ*.)

*Serranus luciopercanus*, Poey, Memorias, i, 56, pl. 9, fig. 1, 1851, Havana; Jordan & Eigenmann, *l. c.*, 410, 1890; Boulenger, Cat., i, 294.

*Centropristis luciopercanus*, Günther, Cat., i, 84, 1869; Vaillant & Bocourt, Miss. Sci. au Mexique, 1874, pl. v, fig. 1.

*Mentiperca luciopercana*, Poey, Synopsis, 281, 1868.

### 1604. PRIONODES STILBOSTIGMA, Jordan & Bollman.

Head 3; depth 3⅜. D. X, 12; A. III, 7; scales 8–58–18. Body elongate elliptical, less slender than in *Prionodes luciopercanus*; back not much elevated; anterior profile straight from tip of snout to front of dorsal. Snout sharp, 3½ in head, lower jaw considerably projecting, mandible 3½ in head. Mouth rather large; maxillary reaching nearly to middle of pupil, 2 3/7 in head. Eye large, a little shorter than snout, 4 in head. Interorbital space very slightly concave, ridged. Teeth small, anterior teeth of front row in both jaws slightly enlarged; posterior teeth of lower jaw also enlarged; vomerine teeth in a V-shaped patch. Preopercle finely serrate, the lower teeth a little coarser, the margin evenly rounded. Opercle ending in three spines, of which the middle one is considerably the largest; membrane extending beyond spines. Gill rakers moderately long and slender, about 9 developed. Scales small, firm, ctenoid; 11 rows on cheeks; 11 vertical rows on opercle to base of spines; 2 rows on interopercle. Spinous dorsal rather low, not notched; first spine about $1\frac{1}{2}$ in second, fourth very slightly longer than third, as long as from tip of snout to middle of eye, $2\frac{1}{2}$ in head; soft dorsal not elevated, first ray $2\frac{3}{4}$ in head; upper lobe of caudal the longer, $1\frac{2}{5}$ in head; lower lobe $1\frac{5}{7}$ in head; second anal spine strongest, hardly as long as third, which is $3\frac{2}{3}$ in head; first $1\frac{5}{7}$ in second; first anal ray 3 in head; penultimate longest, $2\frac{1}{5}$ in head; last somewhat shorter; pectorals pointed, $1\frac{1}{5}$ in head, reaching beyond tips of ventrals to vent; ventrals $1\frac{2}{3}$ in head; soft dorsal and anal with a few scales. Scales on breast and belly small. Color reddish (probably crimson in life), becoming paler beneath, breast somewhat orange; a few small, round, pale spots on cheeks and opercles; occiput rather dark; lower jaw dusky; a slight bluish shade on preorbital; anterior part of back with small indistinct light and dark specks; large, quadrate, inky-black spot larger than eye at base of soft dorsal, which involves the basal half of several rays, and extends downward almost to lateral line; in this blotch are traces of three darker spots; behind this, three much smaller, roundish, black spots, which extend on fin; below these a row of about 10 round black spots smaller than pupil, on median line of side extending from opposite front of large dorsal spot to base of caudal; below this series some fainter irregular spots of black; extending obliquely upward and backward from above tip of ventral fin to lateral line a large, elliptical creamy or silvery blotch which is about as wide as interorbital and as long as snout and eye; this spot does not reach middle line of belly; spinous dorsal with 3 rows of diffuse, confluent, black spots separated by pale streaks; soft dorsal marked with several black spots, which extend upward from body; above these a pale median longitudinal streak; upper half of caudal red, with a few small black spots, lower lobe inky black, with some pale edgings; outer half of ventrals and anal dusky; pectorals pale. Length of type $7\frac{1}{2}$ inches. In form it agrees very closely with *Prionodes luciopercanus*, but the coloration is quite different. Coast of Ecuador; known from a single example, dredged in 45 fathoms, at the equator. (*στιλβός*, shining; *στιγμα*, spot.)

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* Three specimens from Martinique in the Paris Museum have the following characters: Dorsal X, 12; anal III, 7; scales 8 to 10–85 to 90–25 to 29, pores 56 to 59. Depth of body 3¼ to 3¾ times in total length; length of head 3 times. Snout longer than diameter of eye, which is 3½ times in the length of head; interorbital width 6 to 7 times in length of head; lower jaw strongly projecting, with feeble canine teeth on the sides; maxillary extending to below anterior third or center of eye, the width of its distal extremity ⅖ diameter of eye; snout and vertex naked, cheeks and opercle scaly; preopercle finely serrated, the serræ coarser at the angle and obsolete on the lower border; opercular spines strong. Gill rakers longer than gill fringes, 15 or 16 on lower part of anterior arch. Dorsal originating above base of pectoral; the spines increasing in size to the fourth or fifth, which equals about ⅖ to ½ length of head, and exceeds longest soft rays; no well-marked notch between the spinous and soft portions of the fin. Pectoral obtusely pointed, as long as ventral, ⅔ length of head. Third anal spine longest, about as long as third dorsal. Caudal deeply emarginate, upper lobe the longer. Purplish, with reddish-brown irregular spots or marblings; fins yellow, spinous dorsal partly purple; upper and lower caudal lobes bordered with purple. Total length, 8 inches. Caribbean Sea.

*Prionodes stilbostigma*, JORDAN & BOLLMAN, Proc. U. S. Nat. Mus., 1889, 158, Pacific Ocean, off the coast of Ecuador, 0° 50′ S., 89° 36′ W.; depth 45 fathoms; Station 2809. (Coll. Albatross.)

*Serranus stilbostigma*, JORDAN & EIGENMANN, *l. c.*, 409, 1890; BOULENGER, Cat., I, 294.

## 512. DULES, Cuvier.

*Dules*, CUVIER, Règne Animal, Ed. II, Vol. II, 147, 1829, (*auriga*).

This genus is close to *Prionodes*, from which it differs in the possession of but 6 branchiostegals, and in the truncate form of the caudal fin. In one species the third dorsal spine is prolonged in a whip-like spine.*

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* "Par ce nom de doules (*esclave*) nous avons voulu indiquer la ressemblance de ces poissons avec ceux que depuis longtemps nous avons appelées *thérapous*, nom qui, lui-même assez arbitraire, n'est que la traduction de l'épithète donnée à l'espèce de *Therapon* décrite le plus anciennement (*l'Holocentrus servus* de Bloch)." (Cuvier & Valenciennes.)

American. (*δοῦλος*, a slave, the fish being under the lash of the long dorsal spine.†)

*a.* Third dorsal spine not longer than fourth, 3 in head; second anal spine considerably longer than third, about 2¼ in head; lower jaw little projecting; gill rakers short and few, 6 or 8 in number; jaws scaleless; soft dorsal with small scales; pectoral long, reaching anal. Color brown, with darker cross shades; soft dorsal, anal, and caudal fins checkered with blackish on a white ground; a broad white area or bar before anal fin.

  *b.* Dorsal rays x, 13; head small, acuminate; pectoral fin finely barred with black and whitish, precisely like the caudal fin; a very conspicuous inky-black blotch on front of soft dorsal (at least in young specimens), this being a continuation of one of the bars on the body; a black ring about tail at base of caudal, before which are 6 or 7 dark bars, becoming progressively broader and fainter forward; lower parts of head with a conspicuous network of dark streaks. SUBLIGARIUS, 1605.

  *bb.* Dorsal rays x, 12; head less slender; pectorals red; inky blotch on soft dorsal small or obsolete; dusky bars on body distinct. DISPILURUS, 1606.

*aa.* Third dorsal spine in the adult male greatly elevated, reaching past middle of soft dorsal, its length quite variable; second anal spine as long as third, 2⅚ in head; lower jaw prominent; gill rakers 10 to 12 below arch; pectoral shorter than head; brownish, lower parts with light and dark shades; fins clouded. AURIGA, 1607.

### 1605. DULES SUBLIGARIUS (Cope).

Head 2½; depth 2⅔; eye rather large, 4 in head. D. X, 13; A. III, 7; scales about 6–42–17. Body rather deep, compressed, the back elevated, the anterior profile nearly straight. Head long and low, slender, acuminate, its depth at middle of eye but half its length in the smaller specimen, in the larger proportionately deeper. Mouth rather small, lower jaw scarcely projecting; maxillary reaching to posterior margin of pupil, its length 2⅓ in head; teeth small, the canines little developed, those on sides of lower jaw largest. Preorbital and interorbital space very narrow. Edge of preopercle subequally and rather sharply serrate; none of the teeth directed forward. Gill rakers short, rather few. Scales on cheek small, in about 10 series. Dorsal fin scarcely emarginate, the fourth spine not elevated, about 2½ in head, a little lower than the soft rays; caudal subtruncate, a little more than half head; second anal spine longer and stronger than third, 2⅓ in head; ventrals 1¾ in head; pectorals 1⅗; neither reaching front of anal; dorsal and anal fins, jaws, preorbital, and front of head scaleless. Olivaceous, tinged with reddish above, paler below but not silvery; each scale on the sides with a blackish margin, these forming rather faint, continuous, dusky streaks; posterior part of sides with faint traces of about 5 irregular cross shades of darker along the sides; a large blotch of cream color in front of the vent, extending upward as an irregular cross bar to near the middle of the side, its posterior edge sharply defined, its anterior fading into the color of the belly; a black ring around tail behind dorsal and anal; a large black blotch on front of soft dorsal, extending downward on the body, where it is less distinct than on the fin; cheeks yellowish; opercles darker; lower parts of head brown, the preopercle (below), interopercle, lower jaw, and branchiostegals covered by a network of wavy bluish streaks; spinous dorsal dark gray, mottled; soft dorsal similarly and more distinctly marked; pectorals, anal, and caudal grayish, with sharply defined narrow blackish bars, somewhat undulating; ventrals faintly barred, mostly black. South Atlantic coasts of the United States, in rather deep water; not common; recorded from Beaufort, Charleston, Pensacola Snapper Banks, and Big Gasparilla; a small and very pretty species. (Here described from a specimen, No. 30859, U. S. Nat. Mus., 3 inches long, taken by Jordan & Stearns from the Snapper Banks, off Pensacola. (*subligarius*, wearing a truss, in allusion to the white cross band.)

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† According to Dr. Boulenger this prolonged spine is a character of the male. We do not know the foundation of this statement, and in other *Serranidæ* no such sexual differences exist.

*Centropristis subligarius*, Cope, Proc. Ac. Nat. Sci. Phila., 1870, 120, Pensacola.

*Serranus subligarius*, Goode & Bean, Proc. U. S. Nat. Mus., 1882, 238; Jordan & Gilbert, Proc. U. S. Nat. Mus., 274, 1882; Jordan & Gilbert, Synopsis, 535, 1883; Jordan, Proc. U. S. Nat. Mus., 1884, 39; Jordan & Eigenmann, *l. c.*, 405, 1890.

### 1606. DULES DISPILURUS (Günther).

Head $2\frac{3}{4}$; depth $2\frac{3}{4}$. D. X, 12; A. III, 7; scales 5–45–14. Preoperculum rounded, finely serrated behind, entire below, without projecting angle. Eye of moderate size, $\frac{2}{9}$ length of head. Diameter of eye much more than width of the interorbital space, but somewhat less than the extent of the snout, contained $4\frac{1}{2}$ times in the length of the head. Opercles scaly; the scales on the preoperculum in 7 or 8 series, much smaller than those on the operculum and rest of the body. Cleft of the mouth oblique, the upper maxillary reaching to the vertical from the center of the eye; preorbital somewhat wider than the maxillary. Preoperculum rounded, finely serrated behind, entire below; suboperculum and interoperculum entire. Operculum with 3 flat short points, the upper and lower of which are concealed by the scales, the middle one being the longest and sharpest. Dorsal fin commencing just above the extremity of the operculum; its spinous portion scarcely lower, but longer than the soft; the fourth, fifth, and sixth spines are the longest, more than $\frac{1}{3}$ the length of the head; the first spine is very short, half as long as the diameter of the eye; soft dorsal rounded; the anterior and middle rays the longest, the sixth being not quite twice as long as the last spine; caudal fin truncated, slightly rounded at the angles, about $\frac{1}{6}$ of the total length; anal with the soft portion narrow and deeper than the dorsal fin; second anal spine strong and long, $\frac{2}{5}$ the length of the head; third anal spine much longer than the first; pectoral long, rounded, reaching to above vent, $\frac{4}{5}$ of the length of the head; ventrals not reaching to vent. Teeth villiform; several larger teeth in the outer series of each jaw; vomerine and palatine teeth in narrow bands; tongue toothless. Brownish olive, with indistinct darker cross bands extending on the dorsal fin; a broad white cross band on the belly, before the vent, extending upward to the level of the pectoral fin; a small deep-black spot behind the top of the last dorsal spine, on the middle of the first two dorsal rays; several other irregular more or less distinct spots on the dorsal fin corresponding to the cross bands on the body; the soft vertical fins with transverse series of small brown spots; a small black round spot above and below on the root of the caudal fin; pectoral red; ventral blackish. (Günther); description of types, 2 specimens, 4 inches long, from Trinidad. (*δίς*, twice; *σπίλος*, spot; *οὐρά*, tail.)

*Centropristis dispilurus*,* Günther, Proc. Zoöl. Soc. Lond., 1867, 99, Trinidad.

### 1607. DULES AURIGA, Cuvier & Valenciennes.

Head $2\frac{4}{5}$; depth $2\frac{4}{5}$; eye $3\frac{1}{2}$; snout 4. D. X, 13; A. III, 7; scales 6–48–15, pores 45 to 50. Branchiostegals 6, the first being obsolete. Body rather deep and compressed; anterior profile steep and nearly straight; mouth rather small, the lower jaw protruding; preorbital rather narrow, as broad as pupil; top of head naked; the frontal area large and well defined, broader than long; occipital crest low and short, shorter than the frontal area; teeth small, with no marked canines; gill rakers rather short and slender, x + 9, besides rudiments (12 to 14 in all); maxillary $2\frac{2}{5}$ in head; scales large, those above in series parallel with the lateral line; scales on breast small; third dorsal spine extremely long, reaching beyond middle of soft dorsal; other spines all short and even; soft dorsal moderate, a little scaly at base; dorsal not notched; caudal truncate; second anal spine $2\frac{5}{6}$ in head, as long as third, and a little stouter; pectoral $1\frac{9}{10}$ in head. Coloration in spirits, brownish; a dark area from front of anal up to soft dorsal; before this a whitish area, upper parts with dark streaks along the rows of scales, these faint and not continuous; a dark band upward from middle of base of ventrals; fins clouded. Length 10 inches. Coasts of Brazil and Uruguay; said to range occasionally northward; once reported by De Kay from New York, probably by error. Our description from several specimens (4531, M. C. Z.), the longest about $5\frac{1}{2}$ inches long, collected by Professor Agassiz at Rio de Janeiro. (*auriga*, a coachman, from the whip-like dorsal spine.)

*Dules auriga*, Cuvier & Valenciennes, Hist. Nat. Poiss., III, 112, pl. 51, 1829, Brazil; De Kay, New York Fauna: Fishes, 34, pl. 10, fig. 34, 1842; Jenyns, Zoöl. Beagle, Fishes, 16, 1840; Castelnau, Anim. Nouv. ou rares Amér. Sud, 6, 1855; Günther, Cat., I, 266; Jordan & Gilbert, Synopsis, 542, 1883 (description from the original type); Jordan, Proc. Ac. Nat. Sci. Phila., 1884, 98; Jordan & Eigenmann, *l. c.*, 395; Berg, Enum. Pesces Argéntina y Uruguaya, 45, 1895.

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* *Centropristis dispilurus*, from Trinidad, is said to have the dorsal x, 12, the dorsal spot small, and the pectorals red; otherwise the description agrees entirely with *Dules subligarius*. With the account of *dispilurus* the short description given by Cuvier and Valenciennes of *Dules flaviventris* is in perfect agreement. One of the types of Brisout de Barneville's *Centropristis brasiliensis* is preserved in the museum at Paris, where it has been examined by us. It is .095 millimeters in length, and was sent from the museum at Geneva. This specimen has the dorsal rays x, 12, the dorsal spot obscure and diffuse, but is otherwise similar to *subligarius*. All specimens have the second anal spine long, the caudal barred, a white bar before anal, the caudal truncate, with other characters, which readily distinguish this species from all others related to it. It is not unlikely, therefore, that *subligarius*, *brasiliensis*, *flaviventris*, and *dispilurus* are synonyms of *auriga*. If 2 species exist, *subligarius*, the northern form, would be separated from the *auriga* by the presence of 13 dorsal rays, by having the pectoral fin barred like the caudal, and the black spot on the dorsal very large. It may be, however, that *auriga* or *brasiliensis* represents the adult of the species, *auriga* or *dispilurus* younger specimens, and *subligarius* those still younger. In the type of *brasiliensis* the head is considerably less slender than in *subligarius*. This is probably a matter of age. This species reaches but a small size, none of the known specimens being 6 inches in length, the largest of *subligarius* but 4. Dr. Boulenger places all these nominal species in the synonymy of *Dules auriga*, regarding *flaviventris* as the female and *auriga* as the male. Dr. Carlos Berg (Enum. Peces Argéntina y Uruguaya, p. 45, 1895), reaches the same conclusion. He remarks: "Most male examples have the white ventral spot which Cuvier & Valenciennes indicate only in the female, *Dules flaviventris*." *Dules subligarius* is certainly different from *Dules auriga* both in form and color.

*Dules flaviventris*, Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 113, 1829, Brazil; Günther, Cat., i, 267, 1859.

*Centropristis brasiliensis*, Brisout de Barneville, Revue Zoologique, 1847, 131, Bahia; sent to Paris from the Museum of Geneva; Günther, Cat., i, 85, 1859.

*Serranus brasiliensis*, Jordan, Proc. U. S. Nat. Mus., 1886, 533 (from type).

*Serranus flaviventris*, Jordan & Eigenmann, *l. c.*, 406, 1890.

*Serranus auriga*, Boulenger, Cat., i, 287.

## 513. PARANTHIAS, Guichenot.

*Brachyrhinus*, Gill, Proc. Ac. Nat. Sci. Phila., 1862, 236, (*creolus* = *furcifer*) (preoccupied in entomology).

*Paranthias*, Guichenot, Ann. Soc. Linn. Maine-et-Loire, x, 1868, (*furcifer* = *creolus*).

Body strongly compressed; snout short; maxillary broad, scaly, its supplemental bone reduced to a rudiment; teeth small, recurved, in narrow bands, 2 to 4 canines in front; preorbital very narrow; preopercle serrate, with a salient angle; gill rakers slender and numerous; scales small, ctenoid; lateral line complete, running high, the tube with an ascending tubule on each scale; dorsal fin low, of 9 short spines, the third longest; soft dorsal low, long, like the soft anal, closely scaled at base; anal short and small, its spines graduated, its rays III, 9 or 10; pectorals long, obtusely lanceolate, symmetrical, with 20 or 21 rays; ventrals long, close together, inserted behind pectoral; a fleshy ridge extending backward from axilla; caudal deeply forked; branchiostegals 7; frontal bones* with an anterior concavity for the reception of posterior processes of premaxillaries and with a knob-like process on each side behind interorbital area; supraoccipital bone extending forward to between postfrontal processes; supraoccipital and parietal crests produced on the frontals to between orbits; vertebræ $10 + 14 = 24$; pyloric cœca 6 to 8. One of the most strongly marked genera. But one species is known, a beautifully colored fish, inhabiting deep waters. (παρά, near; *Anthias*, a related genus.)

### 1608. PARANTHIAS FURCIFER (Cuvier & Valenciennes).

(Rabirubia de lo Alto; Creole Fish.)

Head $3\frac{2}{3}$; depth 3; snout about 4 in head; eye about 4. D. IX, 18 to 20; A. III, 9 or 10; scales 12–120 to 135–35, pores 77 to 85. Body moderately elongate, strongly compressed; the profile convex and the snout short, as in *Anthias*; maxillary reaching to below middle of eye, $2\frac{3}{5}$ in head; maxillary broadened posteriorly, its surface scaled, as in *Anthias*, its distal extremity $\frac{1}{2}$ to $\frac{3}{5}$ eye; teeth small, recurved, in a narrow band in each jaw, 2 to 4 straight canines near the front of each jaw; preorbital very narrow; preopercle finely serrate, with salient angle or enlarged teeth; gill rakers long, slender, and close-set, $12 + 20$ in number, the longest $\frac{3}{4}$ eye; scales small, closely and regularly imbricated, most of them strongly ctenoid; dorsal fin low, the spines strong, the third longest, $2\frac{1}{3}$ in head; soft rays of dorsal low, scarcely higher than longest spine; anal short, its longest (second) soft ray 2 in head, its third spine longest, 2⅔ in head; ventrals narrow, 1½ in head, not reaching vent; pectorals lanceolate, as long as head; humeral scale long. Color bright red, or salmon color, with 3 small violet spots, 1 on side of back and 1 or 2 on the tail; a bar of similar color extending from upper corner of pectoral across the humeral process; sides with faint oblique streaks along the rows of scales; dorsal fin with a longitudinal blackish streak. Both coasts of tropical America, Cuba to Brazil, Cape San Lucas to the Galapagos, common about the outlying islands; the specimens here described from Havana. We are not able to separate the Pacific form (*colonus*) from the Atlantic (*furcifer*). A most beautiful fish. (*furca*, fork; *fero*, I bear; from the form of the caudal.)

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* For an account of the skeleton see Günther, Cat., i, 101.

*Serranus furcifer*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., II, 264, 1828, Brazil.

*Serranus creolus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., II, 265, 1828, Martinique, San Domingo; GÜNTHER, Cat., I, 100, 1859; STEINDACHNER, Ichth. Beiträge, IV, 6, 1875.

*Corvina oxyptera*, DE KAY, New York Fauna: Fishes, 77, pl. XXX, fig. 96, 1842, locality unknown.

*Serranus colonus*, VALENCIENNES, Voyage Vénus, Zoöl., 300, pl. 2, fig. 1, 1846, Galapagos Islands.

*Anthias furcifer*, GÜNTHER, Cat., I, 91, 1859.

*Brachyrhinus creolus*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 249.

*Paranthias creolus*, GUICHENOT, Ann. Linnæan Soc., X, 1868.

*Paranthias furcifer*, GUICHENOT, Ann. Linnæan Soc., X, 1868.

*Brachyrhinus furcifer*, JORDAN & GILBERT, Synopsis, 916, 1883.

*Paranthias furcifer*, JORDAN & EIGENMANN, *l. c.*, 381, 1890; BOULENGER, Cat., I, 273.

### 514. HEMIANTHIAS, Steindachner.

*Hemianthias*, STEINDACHNER, Ichth. Beiträge, I, 4, 1874, (*peruanus*).

This genus is very close to *Pronotogrammus*, from which it differs chiefly in the more posterior insertion of the ventrals, which are not before the axil of pectoral. Scales smaller than in *Pronotogrammus*. Vertebræ 25 or 26. Species American. (ἥμι, half; *Anthias*.)

*a.* Scales 5-56-20; pectoral short, 1⅔ in head; color rose red, with diffuse golden-brown spots. PERUANUS, 1609.

*aa.* Scales 3-48-16; pectoral 1¼ in head; color carmine, much mottled with golden yellow. VIVANUS, 1610.

#### 1609. HEMIANTHIAS PERUANUS, Steindachner.

Head 3⅓; depth 3; eye very large, 4¼ in adult. D. X, 14; A. III, 8; scales 4 or 5-56-20. Pectoral fin short, 1⅔ in head; middle rays of caudal as long as head; body compressed, rather deep, deepest behind the head; head compressed, almost as deep as long; anterior profile nearly straight, moderately steep; mouth moderate, very oblique, the lower jaw projecting, its tip entering the profile; preorbital narrow, as broad as pupil, its edge roughened with mucous tubes; maxillary 2 in head, naked, very broad at tip, its width ¾ eye; snout 4¼ in head; snout, forehead, and top of head naked; teeth very small, in very narrow bands; 2 canines each directed outward, in front of lower jaw, a smaller one turned backward before middle of side of jaw; upper jaw with a single short canine directed forward on each side in front; interorbital region flattish, with two bony ridges and a median depression; smooth area of frontal region of skull short and small, broader than long; occipital crest high and long; preopercle sharply serrate, its angle a right angle; gill rakers very long, slender, and close-set, x + 23, the longest ⅗ the eye; branchiostegals 7; dorsal spines rather low, slender, only the third produced in a long stiffish filament, which reaches the third soft ray; soft dorsal naked, the last rays very high, 1⅗ in head; caudal very long, with a narrow fork, the middle rays as long as head, and 1⅖ in the longest; anal high, its spines moderate, graduated; ventrals elongate, the third ray longer than head; ventrals inserted scarcely before axil of pectoral, as in *vivanus*; pectorals shortish, pointed, 1⅔ in head; scales moderate; lateral line complete, running abruptly upward and backward to below sixth dorsal spine, then gradually curving downward. Color rose-red, with small diffuse golden-brown spots on body and on soft dorsal, caudal, and anal. Coasts of Peru and Chile occasionally northward; one specimen taken by the *Albatross* at station 3017 (off the coast of Lower California); the present description from two of Dr. Steindachner's types, 15 inches long, from Payta, Peru. (*peruanus*, from Peru.)

*Anthias (Hemianthias) peruanus*, Steindachner, Ichth. Beitr., I, 4, 1874, Payta; Trujillo. (Coll. Hassler Exp.)

*Pronotogrammus peruanus*, JORDAN & EIGENMANN, *l. c.*, 413.

*Anthias peruanus*, BOULENGER, Cat., I, 322.

### 1610. HEMIANTHIAS VIVANUS (Jordan & Swain).

Head 3½; depth 3½. D. X, 14 or 15; A. III, 7 or 8; scales 3 to 5–53–20, pores 48 to 50. Body rather elongate, compressed; profile convex to the occiput, straight anteriorly; mouth very oblique, the maxillary extending to below pupil, 2⅕ in head; lower jaw with a canine in front on each side directed forward and outward; a canine hooked backward in front of middle of side of jaw; upper jaw with a canine directed forward on each side in front; eye longer than snout, 3 in head; vertical margin of preopercle serrate, the serræ larger below; a short, strong, flat spine at the angle; lower limb entire or serrate; top of head naked from the occiput forward; 5 series of scales on cheek; dorsal spines rapidly graduated to the fourth, which is nearly half head; several of the spines ending in long, fragile dermal filaments; the filament of the fourth spine longest, sometimes reaching caudal; caudal very deeply forked, some of the outer rays produced sometimes half length of body; anal spines graduated, the second 3½ in head, a little shorter than third; pectorals short, 1¼ in head; ventrals produced, longer than pectorals, extending beyond origin of anal, their insertion scarcely before axil of pectoral; lateral line on third row of scales; gill rakers very numerous, x + 30, long and slender. Color carmine, deepest on the back, becoming a clear violet on sides; back and sides everywhere freckled with golden olive, this on the sides becoming reticulations around the violet; a bright golden stripe from eye to base of pectoral above; another from tip of snout along lower border of eye to middle of pectoral; dorsal carmine, the rays tinged with golden; caudal similar; anal golden; pectoral carmine; ventrals red and yellow. Gulf of Mexico, in deep water; one of our most beautifully colored fishes. Length 8 inches. All the known specimens of this brilliantly colored species have been taken off the Snapper Banks between Pensacola and

Tampa, nearly all of them being from the spewings of the speckled Hind, *Epinephelus drummond-hayi.* (From the Red Snapper or *Vivanet*, then called *Lutjanus vivanus*, from the stomach of which this species was first taken.)

*Anthias vivanus*, JORDAN & SWAIN, Proc. U. S. Nat. Mus., 1884, 544, Snapper Banks of Pensacola, (Type, No. 36942. Coll. Silas Stearns); BOULENGER, Cat., I, 323.
*Pronotogrammus vivanus*, JORDAN & EIGENMANN, *l. c.*, 413, 1890.

## 515. PRONOTOGRAMMUS, Gill.

*Pronotogrammus*, GILL, Proc. Ac. Nat. Sci. Phila., 1863, 81 (*multifasciatus*).

Body elongate, compressed, covered with rather large, ctenoid scales; lateral line running very high, close to the dorsal fin; top of head and maxillary naked; mouth short, oblique, the lower jaw projecting; maxillary very broad, without supplemental bone; canine teeth usually present both in front and on sides of jaws; no movable teeth; tongue toothless; posterior processes of premaxillaries extending to between the frontals, which have a deep fossa in front; supraoccipital crest very high, not encroaching on the short, convex, smooth area on top of head, which is more or less depressed; parietal crest feeble; a transverse ridge behind frontals between posterior borders of orbits and before supraoccipital crest. Gill rakers very long, slender, and close-set. Preopercle angular, with prominent teeth. Dorsal with 10 spines, some of them filamentous; anal fin short, with 7 or 8 soft rays; caudal deeply forked, its lobes produced; pectorals obtuse, nearly symmetrical, of 17 or 18 rays; ventrals long, inserted before axil of pectoral. Color red. Beautifully colored American fishes, closely allied to the European genus *Anthias*, but differing in the naked top of head and maxillary, and in the form of the body. (*πρό*, before; *νῶτος*, back; *γραμμή*, line; in allusion to the upward curve of the lateral line.)

*a.* Second anal spine shorter than third; body elongate, the head thick, the lower outline nearly straight; tip of lower jaw fitting into a notch of upper, not entering profile; angle of preopercle slightly projecting, its serræ coarser; dorsal emarginate, the spines slender and pungent, the sixth longest, 3⅓ in head, 1½ times tenth; each spine with a short filament near its tip, as usual in this genus; caudal forked, the middle rays ⅔ the outer, which are not produced; scales large, ctenoid, extending forward from occiput on top of head to middle of orbit; scales on cheek in 6 rows. Rose red, silvery below, the fins light yellow; a dark spot above the middle of each eye and 2 V-shaped olive marks behind head, the apex of the one at the nape, the other at front of dorsal. Scales 2½–38. EOS, 1611.

*aa.* Second anal spine longer than third; dorsal spines rapidly increasing to the fourth, which is about 7 in length of body, thence decreasing to the last. Color reddish, the young with numerous dark rufous bands, descending nearly to the middle. Scales 2–45–12. (Adult unknown.) MULTIFASCIATUS, 1612.

### 1611. PRONOTOGRAMMUS EOS, Gilbert.

Head 2½ to 2⅔; depth 2⅘ to 3; eye very large, 3, much longer than snout. D. X, 15; A. III, 8; scales 2½–38–x. Body elongate, tapering regularly backward from shoulder, the lower outline nearly straight; head thick; mouth terminal, oblique, the mandible laterally included, its tip fitting into an emargination of premaxillaries, not entering profile. Maxillary without supplemental bone, broad, reaching vertical from middle of pupil, 2⅓ to 2½ in length. Teeth in upper jaw in a narrow villiform band, the outer series slightly enlarged, and with 1 or 2 strong canines directed forward and outward. Teeth in mandible small, in a single series, a pair of anterior canines directed forward and outward, and a second pair on sides of jaw directed backward and inward. Teeth in rather broad bands on vomer and palatines; none on tongue. Interorbital space gently concave, the supraocular ridge slightly elevated, its width but little more than half diameter of orbit. Preorbital narrow, its width above middle of maxillary ⅓ pupil. Vertical limb of preopercle usually with a slight emargination above the angle (in adults), the angle itself and a region above the emargination slightly projecting. Teeth of vertical limb fine, equal; those of angle coarser, those below again fine, directed backward; notch above angle usually smooth when present. Two flat spines on opercle; other bones of head entire. Gill rakers long, slender, close-set, about 30 on anterior limb of arch, the longest ½ orbit. Dorsal emarginate; the spines slender, pungent, not flexible, none of them produced or filamentous, each with a short membranous flap behind its tip; spines gradually increasing in height to the sixth, which is contained 3⅓ times in head; the tenth is shorter than any other except the first and second, and is ⅔ the sixth; soft dorsal high, some of the posterior rays highest, not reaching base of caudal, 2 to 2½ in head; anal similar to soft dorsal, its posterior rays in advance of end of dorsal; second anal spine stronger but shorter than third, the length of which is 3⅘ in head; ventrals inserted slightly in advance of base of pectorals, the outer rays somewhat produced, reaching beyond vent and usually to or slightly beyond front of anal; caudal forked, the middle rays ⅔ the length of the outer, which are not produced. Pectorals short, reaching slightly beyond front of anal. Scales large, ctenoid, on both head and body; on top of head the scales cover occiput and send a **V**-shaped patch to above middle of orbits; the rest of interorbital space, the snout, maxillary, preopercle, branchiostegal membranes, and anterior half of mandibles naked. Scales on cheeks in 6 rows; those on opercles larger; all but the central rays of caudal fin well scaled; dorsals and anal naked; pectoral and ventrals scaly on basal portion; lateral line running very high, under end of spinous dorsal separated from dorsal outline by less than 3 full series of scales; under end of soft dorsal it regains somewhat abruptly middle of side and runs straight thence to base of tail. Color rosy red, overlying silvery on sides, and below the fins light yellow; a dusky spot above the middle of each orbit, and 2 **V**-shaped olive-brown marks behind the head, one from nape downward and backward on each side to upper angle of gill openings, the second parallel with it, starting from origin of dorsal; lining of buccal and gill cavities, and peritoneum silvery white. (Gilbert.) Pacific Coast of tropical America; known from several examples, the largest 7 inches long, dredged by the *Albatross* at Station 2996, off the west coast of Mexico, in 112 fathoms. (ἑώς, sunrise, from the coloration.)

*Pronotogrammus eos*, GILBERT, Proc. U. S. Nat. Mus., 1890, 62, Albatross Station 2996, west coast of Mexico; JORDAN & EIGENMANN, *l. c.*, 413, 1890; BOULENGER, Cat., I, 324.

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### 1612. PRONOTOGRAMMUS* MULTIFASCIATUS, Gill.

This species is thus described by Dr. Gill: "D. X, 15; A. III, 7; P. I, 14; V. I, 5; C. 10, 1, 8, 7, 1, 9; scales 3–31 + 2 + 12 = 45–17. The greatest height equals or slightly exceeds a quarter of the length from the snout to the end of the median caudal rays. The head equals a third of that length and contains the diameter of the eye—which is oval—3 times. The snout is less than half the diameter of the eye. The spines of the dorsal rapidly increase to the fourth, which nearly equals a seventh of the length, and thence decrease to the last, which equals about an eleventh of the same. The longest ray about equals the longest spine. The second anal spine is more than twice as long as the first, equals the fourth dorsal one, and is considerably longer than the third anal one. The median caudal rays enter 6⅔ times in the total length, while the longest exceed the greatest height. The pectoral fin commences a little before the end of the first third of the length (32) and equals a quarter of that length. The ventral is inserted considerably in advance of the pectoral (28) and is rather shorter than it. The lateral line is deflected on 2 scales. The color is tawny yellow, with numerous (20) rufous bands descending nearly to the middle and rather wider than the tawny intervals. Only one specimen, whose extreme length was little more than 2 inches, was obtained." (Gill.) Cape San Lucas. (*multus*, many; *fasciatus*, banded.)

*Pronotogrammus multifasciatus*, Gill, Proc. Ac. Nat. Sci. Phila., 1863, 81, Cape San Lucas, (Coll. John Xantus de Vasey); Jordan & Eigenmann, *l. c.*, 413, 1890.

*Anthias multifasciatus*, Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 360; Jordan, Proc. U. S. Nat. Mus., 1885, 377; Boulenger, Cat., I, 324

## 516. ANTHIAS, Bloch.

### (Barbiers.)

*Anthias*, Bloch, Ausländische Fische. VI, 97, 1792, (*anthias*).

*Aylopon*, Rafinesque, Carattere di Alcuni Nuovi Generi, 52, 1810, (*anthias*); the generic name *Anthias* said to be preoccupied.

Body strongly compressed; scales moderate or rather large, ciliate, smooth; lateral line complete, angulated below last rays of dorsal, the tubes straight or with an ascending tubule, and extending along nearly the entire scale; jaws and front scaly; mouth large, protractile; maxillary exposed, its surface scaly; jaws with villiform teeth intermixed with curved canines; a small group of teeth on the vomer and a narrow series on each palatine; tongue smooth or with a few teeth; head entirely scaled; preopercle serrated, without antrorse teeth on the lower border;

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* The following is the original account of the genus *Pronotogrammus*, Gill, based on the present species: "This genus has the form of *Brachyrhinus*. The body is covered by moderate, ctenoid scales. The lateral line runs high on the sides for the greater part of its length, but is abruptly deflected behind, and thence continued along the middle of the caudal peduncle. The head most resembles that of *Brachyrhinus*. The preoperculum is serrated on its posterior margin and has a strong compressed spine at its angle. The operculum has 3 acute angles, the middle continued from an internal rib. The teeth are like those of *Serranus*, etc.; 2 large ones exist on each side of the front, in the margin of the upper jaw, and 1 on each side, near the symphysis in the lower, while there are also 2 on the sides. The vomer and palatine bones have villiform teeth. There are, apparently, only 6 branchiostegal rays. The dorsal is undulated and has 10 spines. The anal has 3 strong spines, the second of which is largest. The lobes of the caudal are acute, the pectorals acutely rounded, and the ventrals angulated."—*Gill.*

opercle with 2 or 3 spines; gill membranes separate; 7 branchiostegals; pseudobranchiæ present; gill rakers very long and slender; a single dorsal fin, with X, 12 to 18 rays, the spinous portion a little longer or a little shorter than the soft; anal short, III, 6 to 8; caudal emarginate; pectoral obtuse-pointed, subsymmetrical rays 17 or 18; ventrals long, below pectorals, close together, each with a strong spine; posterior processes of premaxillaries extending to between the frontals, which embrace a deep fossa in front; frontals very convex, with a transverse ridge behind, between the posterior borders of the orbits and in front of the very strong supraoccipital crest; parietal crests feeble; vertebræ 10 + 15 or 16 = 25 or 26. Tropical seas; the typical species (*Anthias anthias*, L.) a well-known inhabitant of the Mediterranean. (*ἀνθίας*, *Anthias*, ancient name of some large fish, perhaps the Albacore, apparently from *ἄνθος*, a flower.)

### 1613. ANTHIAS ASPERILINGUIS, Günther.

Head 3; depth 2½. D. X, 15; A. III, 7; scales 2 to 4, 40–16, pores 37. A few teeth in the middle of the tongue. Snout scaly, half as long as eye, with straight profile; diameter of eye 2⅔ times in length of head, 1½ interorbital width; lower jaw projecting, partly scaly; maxillary scaly, extending to below center of eye, the width of its distal extremity ⅗ diameter of eye; serræ at angle of preoperculum enlarged, but feeble; 3 opercular spines; 28 gill rakers on lower part of anterior arch. Dorsal originating above opercular cleft; first and second spines shortest; rest subequal and much shorter than the soft rays; no notch between spinous and soft portions; pectoral as long as head; ventral much produced, the longest ray filamentous and nearly reaching caudal; anal spines strong, first short, second slightly shorter than third and as long as longest dorsal spines; soft portion rounded, third and fourth rays longest; caudal crescentic, with the outer rays much produced and ending in filaments. Lateral line forming an angle below last dorsal rays. Red, with golden stripes along the series of scales. Total length 165 millimeters. Atlantic Coast of South America. (Boulenger.) Only the type known. (*asper*, rough; *lingua*, tongue.)

*Anthias asperilinguis*, GÜNTHER, Cat., I, 89, 1859, South America, probably Guiana, (Coll. Sir Robert Schomburgk); BOULENGER, Cat., I, 326.

*Odontanthias asperilinguis*, JORDAN & EIGENMANN, *l. c.*, 416.

## 517. OCYANTHIAS, Jordan & Evermann.

*Ocyanthias*, JORDAN & EVERMANN, new genus, (*martinicensis*).

This genus is close to *Anthias*, from which it differs mainly in the presence of large patches of teeth on the entopterygoids and tongue. Soft dorsal nearly naked. Posterior processes of premaxillaries not reaching frontals, which are very convex behind; parietal and supraoccipital bones extending to between orbits; supraoccipital crest strong, not produced on the frontals. Vertebræ 10 + 16 = 26. From *Holanthias*, Günther, with which it agrees in other respects, *Ocyanthias* differs in the form of the caudal, which is truncate, with prolonged angles. In *Holanthias fronticinctus* the caudal is convex. (*ὀκύς*, swift; *Anthias.*)

### 1614. OCYANTHIAS MARTINICENSIS (Guichenot).

Head 3; depth 2½ to 3. D. X, 15; A. III, 7; scales 2 to 4, 38 to 41–15 to 17, pores 35 to 40. Snout ⅗ diameter of eye, which is 3⅓ times in length of head and a little exceeds interorbital width; lower jaw projecting; maxillary extending to below posterior third of eye, the width of its distal extremity ⅗ to ⅔ diameter of eye; posterior border of preoperculum finely serrated, the serræ enlarged at the angle; middle opercular spine strong; 25 to 27 gill rakers on lower part of anterior arch. Dorsal originating above opercular cleft; first and second spines shortest, third longest, 1½ as long as the following ones, which are equal; soft dorsal rounded, deepest posteriorly; no notch between spinous and soft portions; pectoral as long as head, a little longer than ventrals; latter reaching origin of anal; anal spines strong, first short, second and third equal and as long as last dorsal spine; fourth and fifth soft rays longest; caudal truncate, with the outer rays much produced. Lateral line forming an angle below last dorsal rays. Reddish golden,* with lighter spots; snout and vertex whitish (red?), this color extending as a stripe on the nape to the first dorsal spine, where it terminates in a point. Total length 160 millimeters. Caribbean Sea; known from Martinique and Barbadoes; the present description taken by Dr. Boulenger from the original type. (*martinicensis*, living in Martinique.)

*Aylopon martinicensis*, GUICHENOT, Anthiani, Ann. Linn. Soc., Vol. x, 1868, Martinique. (Coll. Boulenger.)

*Odontanthias martinicensis*, JORDAN & EIGENMANN, *l. c.*, 416, 1890.

*Holanthias martinicensis*, BOULENGER, Cat., I, 317.

## 518. GRAMMA, Poey.

*Gramma*, POEY, Synopsis Piscium Cubensium, 296, 1868, (*loreto*).

Body rather elongate, compressed, covered with rather large, smoothish scales. Lateral line interrupted, concurrent with the back, beginning again on caudal peduncle. Head scaled above, its profile not acute; preopercle serrate; opercle with weak armature. Mouth large, with rather strong canines, especially in front of lower jaw; strong teeth on vomer and palatines; preorbital very narrow, the maxillary not slipping under it; maxillary not scaly; dorsals connected, the spinous part twice as long as the soft part, spines 12 in number; anal spines 3, the soft rays not elevated; pectoral narrow, without thickened rays; caudal somewhat rounded; gill membranes somewhat connected. Gill structures not described (having been cut away in the only specimen known). A singular little fish, apparently allied to the Old-World genera *Pleseops* and *Trachinops*, differing from these and agreeing with *Anthias* in having the ventral rays I, 5 instead of I, 4. Dr. Gill has referred *Gramma* to Bleeker's family of *Pseudochromididæ*, with which it agrees in the form of the lateral line. The *Pseudochromididæ* seem to be, however, an unnatural assemblage, and Dr. Boulenger has separated the percoid elements of this group, referring them to the *Serranidæ*. *Gramma loreto* seems not far removed from *Anthias*, though Poey places it among the *Lutianinæ*. (γραμμή, a line, from the peculiarities of the lateral line.)

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* Color golden red, little paler below, many lustrous green spots on the back; fins all unspotted and more or less yellow; upper part of head red. (Guichenot.)

### 1615. GRAMMA LORETO, Poey.

D. XII, 9; A. III, 9; P. 11; V. I, 5; C. 17; scales 31 + 11 = 42. The following is a translation of Poey's description: Length 50 millimeters. Body oblong, as in *Mesoprion* (*Lutjanus*), the depth equal to length of head, 4⅓ in total; eye large, 3 in head, situated half its diameter from tip of snout; jaws equal; interorbital width ⅝ eye. Mouth large, the maxillaries reaching posterior border of eye. Upper teeth very fine; lower larger, acute, curved; teeth on the palatine arch. Preopercle denticulate; opercle entire. Nostrils near together, near upper anterior border of eye. Pores below eye and along lower jaw. Fins scaleless; soft part of dorsal not ½ length of spinous part. Anal spines weak; ventrals subthoracic; first soft rays reaching beyond anal spines; caudal acute. Lateral line almost touching outline of back, falling interrupted below last dorsal spine, the posterior part ending at middle of caudal. Scales moderate, ctenoid, 45 on a horizontal line; scales on opercles and cheeks; above the head they cease at the nape. Color of body, bluish anteriorly, paler on the sides, passing insensibly into red posteriorly; fins yellowish, the ventral blue anteriorly; membrane of first 4 dorsal spines with a spot of intense blue; 2 short black lines mark region behind eyes, turned obliquely upward, the upper broader. (Poey.) This species is known from a single specimen 2 inches long, sent by Poey to the Museum of Comparative Zoölogy, where it was examined by us. It is in bad condition, the gills being destroyed. (Named for its collector, la Señora Da. Loreto Martínez, "que la pescó en la bahia de Matanzas, y que aprovecha la localidad que habita, playa de Judíos, para enriquecer los museos de sus amigos aficionados a la historia natural." Poey.)

*Gramma loreto*, POEY, Synopsis, 296, 1868, Matanzas, Cuba; GILL, Proc. U. S. Nat. Mus., 1887, 615.

## 519. RYPTICUS, Cuvier.

### (SOAPFISHES.)

*Rypticus*, CUVIER, Règne Animal, Ed. II, Vol. II, 144, 1829, (*saponaceus*).
*Smecticus*, VALENCIENNES, Voyage de la Vénus, 305, 1855, (*bicolor*).
*Rhypticus*, GÜNTHER, Cat., I, 171, 1859, (corrected orthography).
*Promicropterus*, GILL, Proc. Ac. Nat. Sci. Phila., 1861, 53, (*maculatus*).
*Eleutheractis*, COPE, Trans. Amer. Phil. Soc., 1870, 467, (*coriaceus*).

Body oblong, compressed, covered with very small, smooth, embedded scales. Lateral line normal; head scaly. Mouth rather large, oblique, the lower jaw the longer; maxillary with a supplemental bone, as in

*Epinephelus*, with which genus this family agrees in general osteology; smooth area on top of cranium very large, transversely convex, much longer than the supraoccipital crest; interorbital area very narrow; parietal and supraoccipital bones short, with feeble crests which do not extend on the frontals; premaxillaries reaching frontals, which have a fossa in front; teeth all villiform, in bands on jaws, vomer, and palatines; preopercle crescent-shaped, without angle or serratures, but provided with 2 or 3 spinous hooks on the posterior margin; opercle with 2 or 3 spines; gill rakers short. Branchiostegals 7. Dorsal fins separate, the first of 2 or 3 (rarely 4) small spines, the second of many (about 25) soft rays; anal long, rounded, of soft rays only; caudal rounded; pectorals rounded, nearly symmetrical, of 17 rays; ventrals small, I, 5, inserted slightly before pectorals, the spine short and strong. Vertebræ 10 + 14 = 24. Skeleton generally similar to that of *Epinephelus*. Species about 8, all from the seas of tropical America. *Rypticus* is apparently related to the *Epinephelinæ*, from which it is perhaps descended, having suffered degradation in the loss of the anal spines and most of the dorsal spines, in the less roughness of the scales, and in the increase in numbers of the soft rays. The resemblance of *Rypticus* to *Dermatolepis* is especially marked. The Old World genus *Grammistes*, commonly referred to the *Serranidæ*, has much in common with *Rypticus*, but in *Grammistes* the fin formula is D. VII–I, 13; A. 8. (ῥυπτικός, washing, from the soapy feeling of the skin.)

I. RYPTICUS:

*a.* Dorsal spines 2 or 3 (rarely 4).

*b.* Preopercle with 3 spines, the uppermost blunt, and sometimes obsolete, the lower the largest; opercle with three strong spines, the middle one largest; body rather deep, the depth about equal to length of head and 3¼ in length to base of caudal; dorsals slightly connected; ventral fins moderate, nearly twice as long as eye; gill rakers short and thick. Color very dark olive brown, the fins all blackish; sides with vague blotches of light brown. XANTI, 1616.

*bb.* Preopercle with two spines only, the lower scarcely the longer.

*c.* Opercular spines 3, all well developed.

*d.* Color red, with darker cross shades on sides of back; fins all dusky; dorsal fins well separated; body rather elongate. BICOLOR, 1617.

*dd.* Color not red, chiefly olivaceous; dorsal fins distinctly connected by membrane.

*e.* Eye not longer than snout; pores in lateral line 85 to 90. Body comparatively deep, the depth in the adult about equal to length of head and 3 to 3⅓ in length to base of caudal; young more slender; back elevated; first and second dorsal spines subequal, the third smallest; dorsals slightly connected; ventrals very small; gill rakers very small and short, about 8 developed. Color dusky brown, fins marked with blackish and usually with a narrow pale edge; sides generally with irregular pale spots; back and head usually immaculate. SAPONACEUS, 1618.

*ee.* Eye longer than snout; pores in lateral line 67; brownish, with blackish spots and dots. ARENATUS, 1619.

*cc.* Opercular spines 2, small, the uppermost the smaller (the lowermost being obsolete); dorsal fins separated; body moderately elongate; preopercular spines short, bluntish, close together, the uppermost the smaller; first dorsal spine longest, the two fins well separated. Color nearly plain brown, the edges of the scales darker with dark points; sides with some faint paler spots; edges of vertical fins dusky. CORIACEUS, 1620.

II. PROMICROPTERUS (πρό, before; μικρός, small; πτερόν, fin):

*f.* Body comparatively deep, the depth more than length of head and more than ⅓ the length in the adult (less in the young); back considerably elevated; preopercle with 2 developed spines only, the uppermost usually obsolete; upper (median) spine on preopercle often divided, the lowermost larger, directed partly downward; a depression before eye, the sharp snout abruptly projecting; opercular spines small; first dorsal spine a little longer than second, which is nearly or quite free from the soft rays. Color dusky olive brown, somewhat clouded; sides with a few smal lirregular whitish spots; young with brownish spots. BISTRISPINUS, 1621.

*ff.* Body more slender, the depth about equal to length of head and less than ⅓ the length even in the adult; back little elevated; depression before eye slight, the profile not very uneven, slightly convex above eye; preopercle with 3 distinct spines, the upper one small, the middle one largest, rarely divided; opercular spines 3, rather strong, the middle one largest; first dorsal spine slightly longer than second, which is nearly or quite free from the soft rays. Color brownish, irregularly mottled with whitish spots as large as the pupil, some of them with a darker center, these spots extending on all the vertical fins, sometimes wanting in the young; vertical fins and pectorals edged with dusky. NIGRIPINNIS, 1622.

### 1616. RYPTICUS XANTI, Gill.

Head 3¼; depth 3¼; eye 5¼ in head. D. III, 24; A. 16. Preopercle with 3 spines, the uppermost blunt and sometimes obsolete, the lower the largest; opercle with 3 strong spines, the middle one largest; body rather deep, the depth about equal to length of head and 3¼ in length to base of caudal; back moderately elevated; snout short, not very acute, the lower jaw much projecting; anterior profile steep and almost straight; maxillary reaching beyond pupil, 2¼ in head; first dorsal spine longest; dorsals slightly connected; ventral fins moderate, nearly twice as long as eye; pectorals rounded; gill rakers short and thick. Color very dark olive brown, the fins all blackish; sides with vague blotches of light brown. Pacific Coast of Mexico; rather rare; known from Cape San Lucas, Colima and Mazatlan. This species differs from *R. saponaceus* of the Atlantic chiefly in the armature of the head. We have examined the original type and also specimens from Colima and Mazatlan. Our description is drawn from No. 7740, U. S. Nat. Mus., collected by Mr. John Xantus at Colima. (Named for John Xantus de Vasey, the discoverer of the species, once tidal observer at Cape San Lucas, now Director of the Museum at Budapest.)

*Rhypticus xanti*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 250, Cape San Lucas, (Coll. Xantus); JORDAN & EIGENMANN, *l. c.*, 339, 1890.

### 1617. RYPTICUS BICOLOR (Valenciennes).

Head 3⅔; depth 3⅘. Body rather elongate; preopercle with 2 spines; opercular spines 3, well developed; dorsal fins well separated. Color red, with darker cross shades on sides of back; fins dusky. (Valenciennes.) Galapagos Archipelago. This species is known from the description and figure given by Valenciennes. The description speaks of 10 dorsal and 2 anal spines, but it is evident from the figure that this is an ordinary *Rypticus*, the short or rudimentary rays of the dorsal and anal having been taken by Valenciennes for spines. The red coloration, as shown on the figure, is exceptional in this genus, and its correctness may be doubted. It is not unlikely that the species is identical with *Rypticus xanti*. Possibly it is a deeper-water form, analogous to the red forms of certain species of *Mycteroperca*. The plate of this species (issued in 1846) is named "*Rhypticus bicolor*," the name *Smecticus bicolor* appearing in the later text (1855). (*bicolor*, two-colored.)

*Smecticus bicolor*, VALENCIENNES, Voyage de la Vénus, Poissons, 307, pl. II, fig. 2, 1855, Galapagos Archipelago.
*Rhypticus bicolor*, GÜNTHER, Cat., I, 173.
*Rypticus bicolor*, JORDAN & EIGENMANN, *l. c.*, 339, 1890.

### 1618. RYPTICUS SAPONACEUS (Bloch & Schneider).

(SOAPFISH; JABON; JABONCILLO.)

Head 3 to 3⅓ in length; depth 2⅗ to 3¼. D. III, 23 to 25; A. 16 or 17; scales 85 to 90 (pores). Body comparatively deep; young more slender; back elevated; snout rather pointed; lower jaw much projecting; anterior profile before eye a little concave; eye 4½ to 5 in head; maxillary reaching posterior edge of eye, 2⅓ in head; preopercle with 2 straight spines behind; opercle with 3 spines, the middle one largest and nearer the upper than the lower; first and second dorsal spines subequal, the third smallest; dorsals slightly connected; ventrals very small, not half longer than eye; pectorals rounded; gill rakers very small and short, about 8 developed. Color dusky brown, fins marked with blackish and usually with a narrow pale edge; sides generally with irregular pale spots; back and head usually immaculate. West Indies, Pensacola to West Africa and Brazil; generally common. The best-known and most widely distributed of the soapfishes. Our specimens are from Havana, Pensacola, and Bahia. The young specimens are much slenderer in form and more uniform in color than the adult. (*saponaceus*, soapy.)

*Jaboncillo*, PARRA, Difer. Piezas de Hist. Nat., 51, lam. 24, fig. 2, 1787, Havana.
*Anthias saponaceus*, BLOCH & SCHNEIDER, Syst. Ichth., 310, 1801, Havana (after PARRA).
*Rhypticus microps*, CASTELNAU, Anim. Nouv. ou Rares de l'Amér. du Sud, 6, 1855, Bahia (after *Perca microps*, BROUSSONET, a MS. name).
*Rhypticus saponaceus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., III, 63, 1829; GÜNTHER, Cat., I, 172, 1859; POEY, Synopsis, 297, 1868; BOULENGER, Cat., I, 348.
*Rypticus saponaceus*, JORDAN & EIGENMANN, *l. c.*, 340, 1890.

### 1619. RYPTICUS ARENATUS,* Cuvier & Valenciennes.

"This fish, which is known only from young specimens, differs from the young *R. saponaceus* in the larger eye, which exceeds the length of the snout and is less than ¼ the length of the head, and the smaller number of tubes in the lateral line (67 instead of 85 to 90). Gray or pale brown, with blackish dots or small round spots; fins pale. Total length 65 millimeters." (Boulenger; from Bahia examples.) West Indies and coast of

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*The scanty description of a young example published by Gill, under the name of *Rhypticus subbifrenatus*, seems to approach very closely to *R. arenatus*. The following is the substance of Dr. Gill's account of *R. subbifrenatus*: Color dusky, with remote dark spots; head with 2 series of spots; one series of 4 between orbit and opercular spine; the other of 3 smaller spots between eye and suprascapula; head 2⅘ in length (3½ with caudal); depth 3¾ (4½ with caudal). D. III, 23; A. 15.

Brazil; recorded from Jamaica, Trinidad, Bahia, and St. Thomas; not seen by us. (*arenatus*, sanded, from the speckled coloration.)

*Rhypticus arenatus*, Cuvier & Valenciennes, Hist. Nat. Poiss., III, 65, pl. 45, 1829, Brazil; Günther, Cat., I, 173, 1859: Boulenger, Cat., 349.

? *Rhypticus subbifrenatus*, Gill, Proc. Ac. Nat. Sci. Phila., 1861, 53, St. Thomas.

*Rypticus arenatus*, Jordan & Eigenmann, *l. c.*, 340, 1890, in part; partly taken from Steindachner, Ich. Notiz., VI, 41, which may be the young of *R. saponaceus.*

? *Rhypticus nigromaculatus*,[*] Steindachner, Ichth. Notiz., VI, 42, 1867, Barbadoes.

*Rypticus nigromaculatus*, Jordan & Eigenmann, *l. c.*, 341, 1890.

### 1620. RYPTICUS CORIACEUS (Cope).

Head 3¼; depth 3⅛. D. III–25; A. 15. Opercular spines 2, small, the uppermost the smaller (the lowermost being obsolete); dorsal fins separated; body moderately elongate, the back elevated, the head low, slender, and pointed, the anterior profile almost straight; lower jaw much projecting; eye small, smaller than in *R. saponaceus*, 5 to 5½ in head; about equal to the short snout; maxillary reaching posterior edge of eye, 2⅖ in head; preopercular spines short, bluntish, close together, the uppermost the smaller; first dorsal spine longest, the 2 fins well separated; ventrals moderate, nearly twice as long as eye; gill rakers small and short. Color (in our specimen) nearly plain brown, the edges of the scales darker with dark points; sides with some faint paler spots; edges of vertical fins dusky. West Indies; recorded from St. Martins and Jamaica; our description from No. 30130, U. S. Nat. Mus., from Kingston, Jamaica. This species seems to be distinguished from *R. saponaceus* by the weak armature of the head, and by the greater distance between the dorsal fins. Dr. Boulenger places it in the synonymy of *R. saponaceus.* (*coriaceus*, leathery.)

*Eleutheractis coriaceus*, Cope, Trans. Am. Phil. Soc., 1870, 467, St. Martins. (Coll. Dr. J. Van Rijgersma.)

*Rypticus coriaceus*, Jordan & Eigenmann, *l. c.*, 341, 1890.

## Subgenus PROMICROPTERUS, Gill.

### 1621. RYPTICUS BISTRISPINUS (Mitchill).

Head 3; depth 2⅓ to 2⅔. D. II–25; A. 14 or 15. Body comparatively deep, the depth greater than length of head, especially in the adult, in which the back is considerably elevated. A depression before eye, the sharp snout abruptly projecting; eye in adult nearly as long as snout, 5½ in head; maxillary 2⅓ in head, reaching to below posterior margin of eye; preopercle with only 2 developed spines, the uppermost being usually wholly wanting; the median spine often divided, the lower one largest and directed partly downward; opercular spines small; first dorsal spine a little lower than second, which is nearly or quite free from the soft rays; gill rakers short and thick, close-set, 8 to 10 in number. Color dusky olive brown, somewhat clouded; sides with a few irregular whitish spots; young spotted with brownish. South Atlantic Coast of United States, in rather deep water, frequent off Charleston, Pensacola, and Key West, occasional as far north as Newport, Rhode Island; here described from specimens from Pensacola. (*bistrispinus*, twice three spines.)

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[*] *Rypticus nigromaculatus* (Steindachner): Head 3⅓ (with caudal); depth 4½. D. IV, 22 or 23; A. about 12. Dorsal spines 4; color brown; body and base of dorsal covered with round, jet-black spots, each surrounded by a clear ring; these spots lie in 5 longitudinal rows, those of the middle row much larger than the others; a sixth row on base of dorsal and 2 or 3 spots on base of anal; fins dusky, without paler margin. (Steindachner.) West Indies; known from a single specimen 1¾ inches long taken at Barbadoes. Except that it is said to have 4 dorsal spines, the description agrees with that of *R. arenatus*, and *R. nigromaculatus* is probably simply an accidental variation of the latter.

*Bodianus bistrispinus*, MITCHILL, Am. Monthly Magazine and Crit. Review, Feb., 1818, 247, Straits of Bahama.

*Rhypticus maculatus*, HOLBROOK, Ichth. S. Car., Ed. 1, 39, 1856, and Ed. 2, 42, 1860, Cape Romain, South Carolina; GÜNTHER, Cat. Fishes, I, 173; JORDAN & GILBERT, Synopsis, 543, 1883.

*Rhypticus pituitosus*, GOODE & BEAN, Proc. U. S. Nat. Mus., 1879, 341, Key West; JORDAN & GILBERT, Synopsis, 543, 1883.

*Rhypticus decoratus*, JORDAN & GILBERT, Synopsis, 543, 1883 (not of GILL).

*Rypticus bistrispinus*, JORDAN & EIGENMANN, *l. c.*, 338, 1890; BOULENGER, Cat., I, 350.

### 1622. RYPTICUS NIGRIPINNIS,* Gill.

Head 3 to 3½; depth 3 to 4. D. II–24 to 26; A. 16; pores 80 to 85. Body more slender than in *R. bistrispinus*, the depth about equal to length of head and less than ⅓ the length, even in the adult; back little elevated; preopercle with 3 distinct spines; maxillary 2⅗ in head, not quite reaching posterior border of eye; depression before eye slight, the profile not very uneven, slightly convex above eye; eye as long as snout, 5½ in head; lower jaw much projecting; preopercle with 3 distinct spines, the upper one small, the middle one largest, rarely divided; opercular spines 3, rather strong, the middle one largest; first dorsal spine slightly longer than second, which is nearly or quite free from the soft rays; gill rakers short and thick, about 8 developed. Color brownish, irregularly mottled with whitish spots as large as the pupil, some of them with a darker center, these spots extending on all the vertical fins, sometimes wanting in the young; vertical fins and pectorals edged with dusky Pacific Coast of tropical America, Cape San Lucas to Panama; not uncommon. (*niger*, black; *pinna*, fin.)

*Rhypticus nigripinnis*, GILL, Proc. Ac. Nat. Sci. Phila., 1861, 53, Panama, (Coll. Dow); BOULENGER, Cat., I, 349.

*Rhypticus maculatus*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 251, Cape San Lucas, (Coll. Xantus); not of HOLBROOK.

*Promicropterus decoratus*, GILL, Proc. Ac. Nat. Sci. Phila., 1863, 164, Panama, (Coll. Dow).

*Rhypticus decoratus*, GÜNTHER, Fishes Cen. Am., 412, 1869.

*Rypticus nigripinnis*, JORDAN & EIGENMANN, *l. c.*, 339, 1890.

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* We have examined numerous specimens of this species, including the original types of *nigripinnis*, *maculatus*, and *decoratus*. There is no doubt whatever of the identity of these three. *R. maculatus*, Gill, is said to have 3 dorsal spines, but this is an error, the first (broken) soft ray on the type having been counted as a spine. We have compared *R. nigripinnis* with *R. bistrispinus*, and find the two apparently different, although very nearly related. In *nigripinnis* the body is less deep, and there are 3 opercular spines, while the Atlantic species has usually but 2.

## Family CXLVII. LOBOTIDÆ.

### (The Triple-tails.)

This family is thus defined by Dr. Gill:*

"*Percoidea* with an oblong, compressed body, equally developed above and below; a short snout and anterior eyes; edentulous palate; dorsal and anal with the soft portions equal and opposite, the former preceded by a much larger spinous portion, the latter with 3 spines; vertebræ 24, 12 abdominal and 12 caudal, the fifth to eleventh with short but gradually lengthening parapophyses projecting sideways and behind downward, and the twelfth with the parapophyses elongated, converging at their extremities, and fitting into a groove of the first hæmal spine, the costiferous pits excavated obliquely in the developed parapophyses, and gradually ascending forward on the vertebræ, and finally on the neurapophyses; the skull with its frontal portion broad, expanded forward and outward, and entering into the posterior borders of the orbits, which are advanced far forward; the postfrontals elongated forward and underlying the frontals; ethmoid short, decurved, and expanded sideways." This family contains a single species, a large fish closely allied to the *Serranidæ*, but lacking vomerine and palatine teeth, and with the fore part of the head very short. Its relations are decidedly with the *Serranidæ* and not with the *Hæmulidæ*, with which group it agrees in the absence of teeth on the palate. (*Pristipomatidæ*, genus *Lobotes*, Günther, Cat., I, 338.)

### 520. LOBOTES, Cuvier.

*Lobotes*, Cuvier, Règne Animal, Ed. 2, II, 177, 1829, (*erate* = *surinamensis*).

Body oblong, compressed, and elevated, covered with moderate-sized, weakly ctenoid scales; profile of head concave, the snout prominent; mouth moderate, oblique, with thick lips; upper jaw very protractile, the lower the longer; maxillary without supplemental bone; jaws with narrow bands of villiform teeth, in front of which is a row of larger conical teeth directed backward; no teeth on vomer or palatines; preorbital narrower than eye; preopercle strongly serrate. Branchiostegals 6. Dorsal fin continuous, with 12 spines which may be depressed in a shallow groove; soft rays of dorsal and anal fins elevated; anal spines graduated; bases of soft dorsal and anal thickened and scaly; caudal rounded. Air bladder present. Pyloric cæca 3 (λοβοτός, lobed; the soft parts of dorsal, anal, and caudal thought to resemble one 3-lobed fin.)

#### 1623. LOBOTES SURINAMENSIS (Bloch).

(Flasher; Triple-tail; Dormeur.)

Head 3; depth 1⅘ to 2¼. D. XII, 15; A. III, 11; scales 47. Head small. Profile from dorsal to occiput strongly convex, from occiput to snout concave; maxillary reaching beyond middle of orbit. Scales around eye very small, those on opercle large. Eye small, much shorter than snout. Preopercular strongly dentate; teeth enlarged on angle, hooked upward on posterior limb. Pectorals shorter than ventrals, which do not reach vent; soft dorsal higher than the spinous portion. Small scales running up on the base of soft dorsal, anal, and caudal. Blackish above, becoming silvery gray on the sides; often blotched and tinged with yellow; fins dusky gray, sometimes with yellow. A large fish of rather sluggish habits, reaching a length of 3 feet, and found in all warm seas; north on our coasts to Cape Cod and Panama; not very common; straying occasionally to the Mediterranean; used as food. Variable, the young looking quite unlike the adult. (Eu.)

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* Proc. U. S. Nat. Mus., 1882, 560.

*Holocentrus surinamensis*, BLOCH, Ichth., pl. 243, 1790, **Surinam.**

*Bodianus triurus*, MITCHILL, Trans. Lit. & Phil. Soc., I, 1815, 418, **Powles Hook, New Jersey.**

*Lobotes erate*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., V, 322, 1830, **Pondicherry.**

*Lobotes farkharii*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., V, 324, 1830, **Malacca**; on a drawing of Major FARKHAR.

*Lobotes somnolentus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., V, 324, 1830, **San Domingo.**

*Lobotes incurvus*, RICHARDSON, Ichth. China, 237, 1846, **China.**

*Lobotes auctorum*, GÜNTHER, Cat., I, 338, 1859, **Cuba**; **Calcutta**; **China**; DODERLEIN, Una Specie del genere Esotico Lobotes a Palermo, 1875, 1.

*Lobotes surinamensis*, HOLBROOK, Ichth. S. C., 169, 1860.

## Family CXLVIII. PRIACANTHIDÆ.*

### (CATALUFAS.)

Body oblong or ovate, compressed, covered with small, firm, rough scales; all parts of the body and head, even the snout and maxillaries, being densely scaly, each scale with a more or less developed plate on its posterior border, most developed in the young. Head deep. Mouth large, very oblique, the lower jaw prominent. Villiform teeth on jaws, vomer, and palatines, none on the tongue. Premaxillaries protractile. Maxillary broad, without supplemental bone, not slipping under the very narrow preorbital, which is usually serrate; no suborbital stay. Eye very large, forming about one-half the length of the side of the head. Posterior nostril long, slit-like, close to the eye. Preopercle more or less serrated, one or more strong spines at its angle; operculum very short, ending in two or three points behind; no barbels. Gill membranes separate, free from the isthmus. Pseudobranchiæ very large, extending along whole length of opercle. Postorbital part of head very short, the opercle small. Gills 4, a slit behind the fourth. Gill rakers long. Branchiostegals 6. Lateral line continuous, not extending on the caudal. Dorsal fin continuous, X, 9 to 15, the spines depressible in a groove; anal rays III, 9 to 15, the soft part long, similar to the soft dorsal, the spines strong; ventrals very large, thoracic, I, 5, close together, in advance of base of pectoral, joined to belly by a membrane which incloses a groove; no axillary process; spine strong; pectorals small, pointed, not symmetrical, of 19 or 20 rays, the upper longest; caudal fin truncate or lunate. Spines

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*For an account of the American species of *Priacanthidæ*, see MORRISON, Proc. Ac. Nat. Sci., Phila., 1889, 160.

of fins generally rough with small serræ. Air bladder large. Pyloric cœca few. Vertebræ in reduced number, 9 or 10+13=22 or 23, the first vertebra being very small or absent; transverse process beginning on the seventh (sixth) vertebra, the last 2 precaudal bridged across; ribs attached to the transverse processes; epipleurals absent on the last three precaudal vertebræ. Supraoccipital crest very low, continued forward to over front of orbit, where it is joined by the parietal crests; processes of premaxillaries moderate. Carnivorous fishes of the tropical seas, chiefly in deep waters; mostly rose-colored in life. The family is a sharply defined group, not close to any other, but the affinities on the whole seem to be nearest to the *Serranidæ* and their tropical allies. Genera 2, species about 10. (*Percidæ*, group *Priacanthina*, Günther, Cat., I, 215–221.)

*a.* Scales very small, 80 to 100 in lateral line; body oblong, its depth not half its length; preopercle with a flat spine; dorsal and anal each with 12 to 15 soft rays. PRIACANTHUS, 521.

*aa.* Scales large and very rough, 35 to 50 in lateral line; body ovate, its depth more than half its length; preopercle without spines; dorsal and anal each with 9 to 11 soft rays. PSEUDOPRIACANTHUS, 522.

## 521. PRIACANTHUS, Cuvier.

*Priacanthus*, CUVIER, Règne Animal, II, 281, 1817, (*macrophthalmus*).

Scales very small, 80 to 100 in the lateral line; body oblong, more than twice as long as deep; preopercle with a spine at angle; interorbital area externally transversely convex, the cranium itself transversely concave, the elevation being formed of flesh; a conspicuous foramen in the interorbital area; lateral line extending upward and backward from upper angle of gill opening toward second dorsal spine, below which it changes its course, following outline of back to end of dorsal fin, thence direct to middle of caudal; anal fin rather long, its rays about III, 14; dorsal rays about X, 13. Species rather numerous, in the tropical seas. (*πρίων*, saw; *ἄκανθα*, spine; some of the fin spines being serrated.)

*a.* Preopercular spine obsolete or nearly so; depth about equal to length of head; dorsal unspotted; dorsal rays X, 14; anal III, 15. ARENATUS, 1624.

*aa.* Preopercular spine well developed; depth of body greater than length of head; dorsal spotted; dorsal rays X, 12 or X, 13; anal III, 13 or 14. CRUENTATUS, 1625.

### 1624. PRIACANTHUS ARENATUS, Cuvier & Valenciennes.

(CATALUFA.)

Head 2¾ to 3⅓; depth 2¾ to 3⅕; eye very large, 2⅕ to 2½ in head. D. X, 14; A. III, 15; scales 9–98 to 115–42, pores 68 to 73. Body oblong, less deep than in *P. cruentatus*. Snout ½ to ⅔ diameter of eye. Posterior nostrils in a single oblong opening, within which is a septum considerably below the surface; gill rakers 20 to 23. Preopercle with its angle terminating in an oblique point, smaller than the spine in *P. cruentatus*; opercle with a flat-pointed spine, which does not project; both spines almost obsolete; shoulder girdle above with a prominent edge; dorsal spines more or less granulate on the edges; last dorsal spine 1⅔ to 2 in head.

Caudal slightly lunate, the upper lobe the longer; ventrals moderate, not extending beyond second anal spine, about as long as head; pectorals 2 in head; third anal spine as long as sixth dorsal; scales smaller near the back. Base of skull pierced with a large foramen between the great wing and the base of the superior sphenoid. (Poey.) Silvery red; anal, soft dorsal, and caudal edged with black; no spots on dorsal; posterior half of ventral black. Tropical Atlantic, south to Brazil, occasionally northward in the Gulf Stream to Newport and Woods Hole; recorded also from Madeira. (*arenatus*, sanded.)

*Catalufa*, PARRA, Dif. Piezas Hist. Nat., pl. 20, 1787, Havana.

*Priacanthus arenatus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., III, 97, 1829, Brazil, (Coll. Delalande.) Atlantic, (Coll. Péron); JORDAN & GILBERT, Synopsis, 971; BOULENGER, Cat., I, 356.

*Priacanthus fulgens*, LOWE, Trans. Zoöl. Soc. Lond., II, 1839, 174, Madeira. (Coll. R. T. Lowe.)

*Priacanthus catalufa*, POEY, Proc. Ac. Nat. Sci. Phila., 1863, 182, Havana; MORRISON, Proc. Ac. Nat. Sci. Phila., 1889, 161.

*Priacanthus macrophthalmus*, CUVIER & VALENCIENNES, Hist. Nat. Poiss., III, 97, 1829; not *Anthias macrophthalmus*, BLOCH, which is an Asiatic species, *Priacanthus hamrur* (Forskål); Günther, Cat., I, 215; JORDAN & GILBERT, Synopsis, 544.

### 1625. PRIACANTHUS CRUENTATUS (Lacépède).

(BIG EYE; CATALUFA.)

Head 3 to 3¼; depth 2½ to 2¾. D. X, 12 or X, 13; A. III, 14; scales 10–100 to 120–50, pores 62 to 76; eye 2⅕ to 2½ in head; snout 1½ to 2 in eye. Body deep; interorbital width 3¼ to 3½ in head; mouth large, oblique, maxillary reaching nearly to middle of eye, 2 in head. Gill rakers 16 to 18 below angle. Dorsal and anal spines all finely serrate in front; preopercle with a rather strong, flat, triangular spine; opercular spine very small; last dorsal spine 1⅔ times length of second, 1⅔ to 2 in head; pectorals small, little longer than eye, 1⅔ to 2 in head; third anal spine nearly as long as last of dorsal; caudal slightly notched; roof of mouth with longitudinal ridges; upper limb of preopercle almost vertical; skull without sphenoid foramen below. Rose color, the back brownish, the dark color of back sometimes forming rounded blotches; dorsal and caudal fins with small dark spots. West Indies to St. Helena and the Canaries; a common food-fish in Havana; not yet recorded from the United States. Also abundant throughout the western Pacific, if *Priacanthus carolinus** is the same, as supposed by Dr. Boulenger. (*cruentatus*, bloody.)

*Labrus cruentatus*, LACÉPÈDE, Hist. Nat. Poiss., III, 522, 1800 (from a copy by AUBRIET of a plate made by PLUMIER at Martinique), Martinique; CUVIER & VALENCIENNES, Hist. Nat. Poiss., III, 102, 1829.

*Priacanthus cepedianus*,† DESMAREST, Prém. Dec. Ichthy., 9, pl. 1, 1823, Havana; POEY, Repertorio, I, 273, 1866.

*Priacanthus cruentatus*, MORRISON, Proc. Ac. Nat. Sci. Phila., 1889, 162; JORDAN, Proc. U. S. Nat. Mus., 1890, 317; BOULENGER, Cat., I, 352.

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* *Priacanthus carolinus*, Lesson, Voyage Coquille, Poiss., 204, 1826, Caroline Islands; *Priacanthus schlegeli*, Hilgendorf, Sitzgber. Ges. Naturf. Fr., 1879, 79, Japan.

† Poey regards *Priacanthus cruentatus* and *Priacanthus cepedianus* as different species, solely distinguished by the presence in *cruentatus* of roundish rosy spots.

## 522. PSEUDOPRIACANTHUS, Bleeker.

*Pseudopriacanthus*, BLEEKER, Versl. Ak. Wet. Amsterd. (2), III, 241, 1869, (*niphonius*).

Scales large, very rough, 35 to 50 in the lateral line; body ovate, not twice as long as deep; preopercle with 2 small spines at angle; interorbital space broad and flat, there being little flesh between skin and skull; no foramen in interorbital area; lateral line changing its course below the fourth dorsal spine; anal short, its rays III, 9 to 11; dorsal X, 11. Otherwise essentially as in *Priacanthus*, the species living in deeper water. (*ψεῦδης*, false; *Priacanthus.*)

*a.* Outer teeth above not enlarged; body with four dark cross bars; eye moderate, $2\frac{1}{3}$ in head in young. SERRULA, 1626.

*aa.* Outer teeth above more or less enlarged; body not banded; eye excessively large, $2\frac{1}{6}$ in head in adult. ALTUS, 1627.

### 1626. PSEUDOPRIACANTHUS SERRULA (Gilbert).

Head $2\frac{2}{3}$; depth $1\frac{4}{5}$. D. X, 11; A. III, 11; lateral line with 36 pores. Eye $2\frac{1}{3}$ in head; interorbital width $3\frac{1}{3}$; length of snout 5. Mouth very oblique, maxillary scarcely reaching vertical from middle of eye, half length of head; teeth in a very narrow band in both jaws and on vomer, none of them enlarged; palatines with a single series. Posterior nostril elliptical, not twice as long as wide. Preopercular and preorbital margins serrate, a group of stronger spines at angle of preopercle. Gill rakers short, about half diameter of pupil, 16 developed on horizontal limb of outer arch. Spinous dorsal high, the longest spine $\frac{5}{6}$ length of head; the first and last spines much shorter, about equaling the soft rays; anal spines similar but shorter, the first 2 equal and longer than third, their length half that of head; pectorals short, barely reaching vertical from vent; ventrals elongate, the spine reaching base of second anal spine, the longest soft ray reaching base of first soft ray of anal. Scales on upper and lower parts of body very small, those on middle of sides conspicuously enlarged. Entire head, including maxillary, mandible, gular, and branchiostegal membranes wholly covered with spiny scales; dorsal and anal fins in a sheath. All spines rough-serrate. Color in spirits: Light olive, with 4 dark cross bars on sides wider than the interspaces, the last one on base of caudal peduncle; vertical fins dusky, the soft portions more or less speckled; ventrals black; pectorals pale. Pacific Coast of Colombia; known from one young specimen, $1\frac{3}{4}$ inches long. (Gilbert.) (*serrula*, a little saw.)

*Priacanthus serrula*, GILBERT, Proc. U. S. Nat. Mus., 1890, 450, Albatross station 2797, west coast of Colombia. (Coll. Albatross.)

### 1627. PSEUDOPRIACANTHUS ALTUS (Gill).

Head $2\frac{8}{9}$; depth $2\frac{1}{9}$. D. X, 11; A. III, 9; pores in lateral line 37; in a series between opercle and caudal, 41. Body ovate; profile straight and little oblique; mouth subvertical; teeth in upper jaw villiform, in a narrow band with an outer series of enlarged teeth; teeth of lower jaw similar, but the inner ones larger than in upper jaw; eye very large, its diameter little less than half length of head; preorbital narrow, strongly serrate; preopercle serrate, the serræ of the lower margin largest; no spines at its angle; subopercle and opercle serrate on their lower margins; highest dorsal spines $1\frac{2}{3}$ in head; anal spines graduated, the third spine $2\frac{1}{5}$ in head; ventrals scarcely reaching anal; pectorals $1\frac{2}{3}$ in head; scales all extremely rough, very strongly ctenoid; lateral line ascending to below fifth dorsal spine, then descending to caudal peduncle, then median to tail. Reddish, overlaid with plumbeous above; bright red or crimson in life; all the fins except the pectorals edged with black; otherwise entirely plain (in spirits). West Indies, in rather deep water, north to Pensacola and Charleston; rare; the very young straying in the Gulf Stream to Rhode Island. Here described from a specimen 11 inches long, the largest yet seen, taken at Charleston by Charles C. Leslie. Very close to the Japanese species, *Pseudopriacanthus niphonius*, (Cuvier & Valenciennes), the scales a little larger. (*altus*, high.)

*Priacanthus altus*, GILL, Proc. Ac. Nat. Sci. Phila., 1862, 132 (very young specimen), Narragansett Bay; JORDAN & GILBERT, Synopsis, 545.

*Pseudopriacanthus altus*, JORDAN & EIGENMANN, Proc. U. S. Nat. Mus., 1887, 269; MORRISON, Proc. Ac. Nat. Sci. Phila., 1889, 163; BOULENGER, Cat., I, 359.

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